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Power Station Extensions

The Example of Norwich

LAST week we recorded that preliminary steps had been taken towards the erection of a new capital station at Little Barford in Bedfordshire. This was scheduled in the original grid scheme of the Electricity Commissioners, and, apart from the one at Littlebrook, near Dartford, which is now in the early stages of construction, it is the only new station in view. These two, even when fully extended, will probably not be enough to meet a couple of years' increase in demand in South-East England alone. For a true appreciation of the position one must turn to the lists of extensions to selected stations arranged by the Central Electricity Board, which last year were equivalent to over 600,000 kW.

Modern plant of this kind will permit of a fuller exploitation of the advantages of suitable sites; a typical example of the difference between present-day practice in this connection and that common a decade ago is furnished by Thorpe power station, Norwich, the recent extensions to which are described in this issue. The first and most obvious advance is in steam conditions, which are 675 lb. per sq. in. and 875 deg. F. against the original 250 lb. and 650 deg. The second is that the output of the new turbo-alternator is nearly three-quarters that of the aggregate of five sets previously installed. Similarly, for the new boilers the same width of boiler-house has been maintained, and 120,000 lb. units have been easily accommodated within the bay centres formerly required for 50,000 lb. A notable feature, too, is the complete system of automatic control of the new boilers by electrical impulses.

Variations in seasonal loads are nowadays not enough in a base-load station to compensate for variations in temperature of river water, and the quantity of cooling water needed for the condensers at Thorpe is about a third more in the summer than in the winter.

The greater power behind faults has entailed the provision of circuit breakers for meeting far more onerous conditions, and the million-kVA switchgear installed is said to be the largest of its kind yet made for 6.6 kV. Nevertheless, doubts that might have been entertained a few years ago as to the ability of circuit-breakers to stand up to such conditions no longer exist. Tests carried out under the B.S. Specification of 1937 included making asymmetrical short-circuit currents of over 266,000 A. Current transformers, once so weak a link, can now be relied upon to withstand corresponding mechanical stresses.

Two tendencies in motor design are to be noticed: one is the use of 3.3-kV stators for feed- and c.w.-pump drives (in the earlier part of the station all motors were wound for 400 V); the other is the number of machines, some of large output, arranged for direct-on-line starting.

A paradox, according to old views, is the idea of extinguishing fires in electrical generating stations with water, the water being, however, in the form of fine spray under high pressure.

The extension has taken about two and a half years to carry out. The considerable amount of civil engineering entailed may be instanced by the driving of 350 reinforced-concrete piles—72 of these for the foundations of the chimney, which called for 1,000 tons of concrete in its construction. For supporting the mass of 38 tons revolving at 3,000 r.p.m. represented by the turbo-alternator, a further 1,200 tons was built up.

New circulating-water culverts were needed, and parts of the old system had to be blown up by gelignite. The change-over from the old to the new culverts took ten days and involved the shutting down of the station for that period. However, the consumers knew nothing of it, as the full supply was obtained from the grid during the period.

Such considerations indicate that the expression "extension" may be misleading. Some stations on the same site and known as "A" and "B" are separated by appreciable distances. Even when old and new plant is housed under the same roof the difference in design may be so marked as to make them, in effect, new stations.

Lancashire Power

IF electricity supply affords a reliable barometer of the state of industry, then the report of the Lancashire Power Co. should indicate how matters stand in an important industrial area of the country. Mr. George Balfour, in his speech at last week's annual meeting of the company, demonstrated that remarkable progress had again been made—maximum load up by 40 per cent., receipts by 36 per cent., and balance on trading by 45 per cent. He said that there had been a great deal of talk about trade decline, but the company supplied electricity to a large number of consumers in the textile trade, iron and coal industries, railways, electro-chemical works, and miscellaneous engineering works, and, judging by the demand of those industries upon their services, they could see no change for the worse in the near future.

Electric Railways Pay

IN discussing railway electrification at a luncheon of the British Railway Stockholders' Union in London on Tuesday Mr. R. Holland-Martin, chairman of the Southern Railway, was speaking to a critical audience. The figures which he quoted, however, were convincing proof that the spending of money on electrification has been justified, the rise in receipts of £640,000 a year representing a return of 14 per cent. on capital expenditure. The chairman's statement will also help to dispel the doubts which have arisen in some quarters following the decision not to proceed at present with the Sevenoaks-Hastings scheme, in spite of the full explanation given at the time.

Trustees of the Future

THE electrical engineering students of to-day are the engineer and scientist of to-morrow. Upon them rests the responsibility for the conduct and progress of our great industry. They should therefore take to heart Sir George Lee's message to the London Students of the I.E.E. at their annual dinner last week. It was, he said, their duty to maintain the scientific tradition of the Institution by assimilating all the knowledge they could and spreading it abroad for the benefit of the generations to come. In this connection we are glad to see that the average attendance at business meetings has risen from 85 to 109, almost a record, during the past year. But not only to the I.E.E. students does this message apply—we pass it on to all those now going through college and shop.

Sussex Electricity

A SELECT Committee of the House of Lords last week rejected a Bill promoted by the Electricity Supply Corporation to effect the amalgamation of its five Sussex subsidiaries. This may seem strange in view of the generally accepted idea that voluntary schemes of co-ordination of small undertakings should be proceeded with in anticipation of the pending legislation on the subject. It was suggested by the opponents of the measure, however, that it was an endeavour to forestall the Government's Bill and place the Corporation in a strong tactical position. The promoters denied that this was their intention. It is worth noting that only one of the five companies —Central Sussex Electricity, Ltd.—sold more than 10 million kWh in 1935; the others would presumably lose their identities under the McGowan Committee's proposals. The chief opponent was the Brighton Corporation, the predominant member of Group 50 in the "White Paper" published last year. Worthing Corporation and the Ringmer Co., who are also in the same group, opposed the Bill, as did the Chanctonbury U.D.C.

More Helpful Suggestions

LAST week we had occasion to refer to some strange suggestions by a writer in an evening contemporary. This week he has been at it again. His advice this time is that municipalities owning supply undertakings should dispose of them to companies and employ the proceeds to reduce the municipal debt. One inducement offered is that such a transaction would "import" a large new ratepayer into the territory. This savours more of naïvété than guile. Why should the purchasers pay more rates than the undertaking pays already? And if they did, who would provide the money but the consumers? What company would be willing to make an investment which would give it less than 5 per cent.? And would the amount paid ever wipe out enough debt to make the "conversion" worth while to a local authority? No! We are afraid that history has shown that the consumer pays in such transactions as this. There may be a few instances in which the sale of a backward municipal undertaking to a company would be worth while, but very rigid safeguards would have to be imposed for the consumers' protection.

Transport and Territorials

WHEN the London Transport Bill came up for second reading in the House of Commons on Tuesday its rejection was proposed on the ground that the L.P.T.B. refused to allow Territorial employés extra holidays for training purposes. The Ministry of Transport, through its Parliamentary Secretary, sympathised with the opponents, although undesirous of seeing the Bill rejected. In the result further consideration was delayed by the passing of a motion for the adjournment. Although the principle of dealing with a Bill otherwise than on its merits is not to be encouraged, it rather looks as though the Board will have to make some concession in order to get its measure through Parliament.

The Value of Space

IF estimates for electricity supply work generally could be made with the same remarkable accuracy as they can for generation—on the lines of Mr. G. O. McLean's article this week—many worries would disappear from the lives of those responsible for distribution and sales. The capital item of generation that is least calculable from area to area is the cost of land and buildings. It is of magnitude enough in any case to weight the scales in favour of machines of large output, even if their thermal efficiency is not much greater than that of lower ratings. Floor area, quite as much as improved efficiency, is also likely to be more and more a deciding factor in the choice of high steam conditions, as the growth of electrical demand will necessitate the production of more and more power from limited dimensions.

Meeting an Emergency

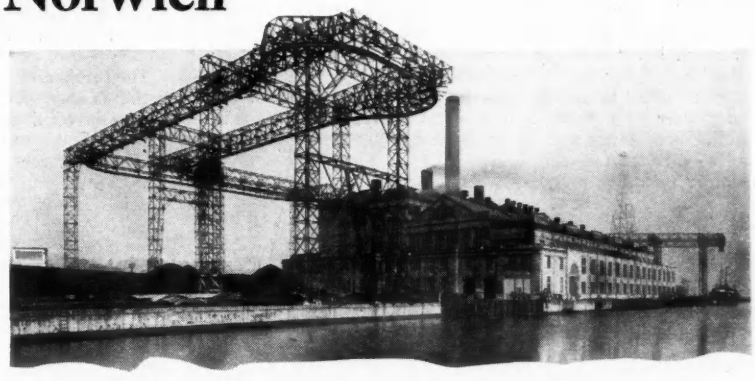
AN appreciable advantage of the electric drive in reducing the period of an interruption in power supply is well illustrated in the case of a cotton mill in the area of the Lancashire Electric Power Co. A fire damaged the engine just before Christmas to an extent that would have required at least four months for restoration of normal working. The Power Co. thereupon promised to have the mill running by the second week in January. This involved not only the installation of more than 1,000 h.p. of motors but the extension of the 10-kV feeders from Padiham power station to Clitheroe and the erection of a sub-station containing two 500-kVA 11,000/440-V transformers. Cable laying was made easier by the existence of ducts previously laid in intelligent anticipation of the day when the mill would be won over to electricity. In spite of delays due to difficulty in obtaining certain material, the company was ready within the specified time, all the installation work being of a permanent character. The arrival of the lorries with the electrical gear on board was received with cheers by the men temporarily thrown out of work. Compensation for the loss incurred by both owners and employés will, however, no doubt be found in the definite increase in production and marked improvement in quality already noticeable as a result of the conversion to electricity.

Extensions at Norwich

New boilers and generating plant inaugurated

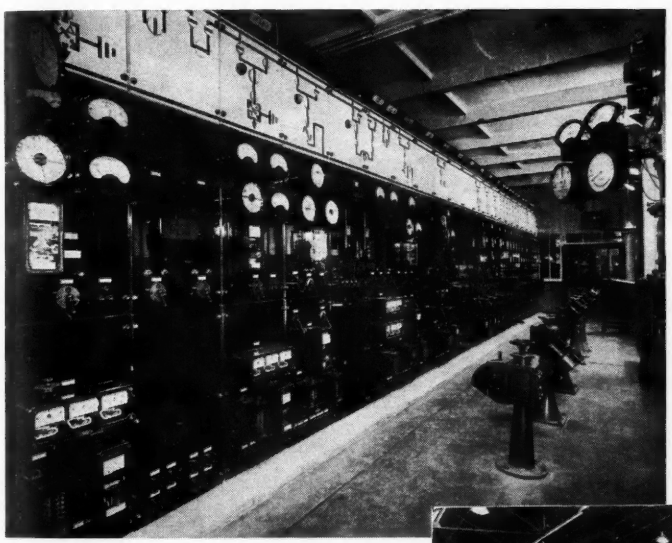
YESTERDAY a 30,000-kW turbo-alternator and four boiler units were officially put into service at Thorpe Power Station by the Lord Mayor of Norwich. The new plant increases the installed capacity from 42,500 kW to 72,500 kW and is the fourth extension here, the last (in 1932) being for 15,000 kW.

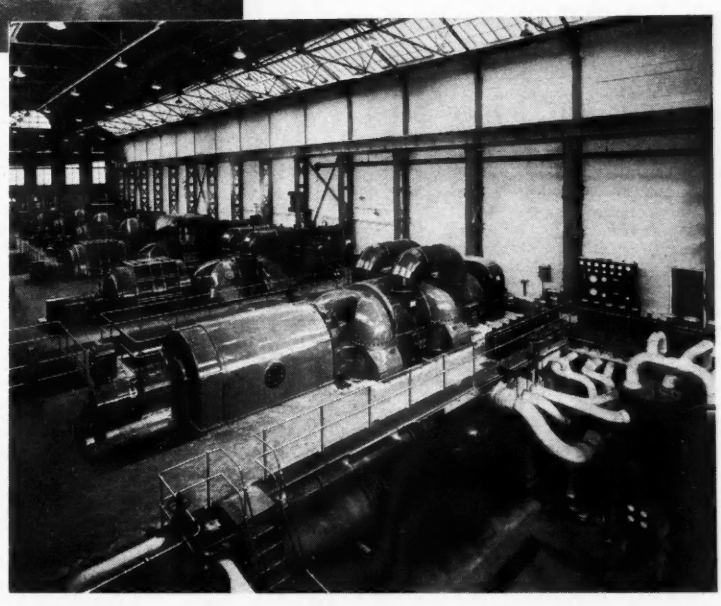
Opened over eleven years ago, Thorpe station superseded the station at Duke Street, which had been running since 1893 when it was equipped by Laurence, Scott and Co. for the Norwich Electricity Co. Duke Street was built to the designs of Mr. W. H. Scott of that firm, in consultation with Professor H. Robinson. Mr. Scott also devised a scheme of distribution that was a modification of the system of bare conductors on insulators in stoneware ducts. Prior to the acquisition of statutory powers by the company, however, Laurence, Scott gave a supply by overhead wires from a small station in the city. The undertaking was acquired by the Corporation in 1902 and a three-phase system was adopted in 1913.



Thorpe Power Station, Norwich

The present station is situated on the banks of the River Wensum, which provides the condensing water on a site that offers facilities for coal delivery by either water or rail and for ample coal storage.





Above: The main control room. Right: Turbine bay showing the new 30,000-kW set in foreground

The four new boilers have individual maximum continuous ratings of 120,000 lb. per hour. Steam conditions are 675 lb. per sq. in. and 875 deg. F. with feed water at 310 deg. Each boiler has three drums of solid forged steel, the largest of which is the rear steam drum weighing 22½ tons and having an internal diameter of 48 in. with a wall thickness of 3⅜ in. There are fifteen rows (back to front) of thirty-six tubes 3¼ in. in outside diameter and 4 s.w.g. thick, presenting a heating surface of 9,365 sq. ft. in addition to which 753 sq. ft. is provided by the Bailey walls. The latter are at the sides and front of the 3,900 cu. ft. combustion chamber, at the back of which is a refractory suspended arch. Twin travelling-grate stokers with grate areas of 324 sq. ft. per boiler are installed. Fine combustible grit is projected from the rear hoppers back into the firing zone by an air blast from an independent fan.

Steady steam temperature is maintained from half to maximum load by means of an automatically operated butterfly valve which by-passes an attemperator between the primary and secondary sections of a multi-loop superheater. Cooling of the attemperator is effected by water in the main circulation of the boiler.

Above each of the gilled-sleeve steaming economisers (12,312 sq. ft. heating surface) is a vertical-shaft regenerative air preheater for the purpose of raising the temperature of the air for combustion to 298 deg. F. Its 12,900 sq. ft. of heating surface is provided by steel plates mounted in a rotor making 4 r.p.m. continuously through the gas and air streams, thus minimising local under-cooling with consequent corrosion and fouling.

On a floor 55 ft. above the firing aisle are the forced- and induced-draught fans, one of each per boiler. Both types are fitted with movable vanes for regulating output. The single-inlet forced-draught fan has a duty of 43,000 cu. ft. per min. at 5 in. w.g. and 80 deg. F.; its backward-thrown blades give a self-limiting horsepower characteristic. Each fan is driven by a two-speed 60/30-h.p. motor running at 970/725 r.p.m.

The induced-draught double-inlet fan is capable of dealing with 66,500 cu. ft. per min. at 7 in. w.g. and has radial top blading with an impeller diameter of 53¾ in. In the inlet scrolls are grit catchers, while secondary vortex collectors separate the dust from the gases. The two-speed driving motor is rated at 165/73 h.p. (970/725 r.p.m.). There are also two 13-h.p. 40-r.p.m. secondary-air fans per boiler having a capacity of 6,500 cu. ft. per min. Gases from the i.d. fans are discharged into a chimney 235 ft. high with an internal diameter of 15 ft. at the top and constructed of reinforced concrete.

A comprehensive metering equipment with full automatic control is embodied in a panel adjacent to each boiler on the firing floor. On this are mounted draught gauges (seven

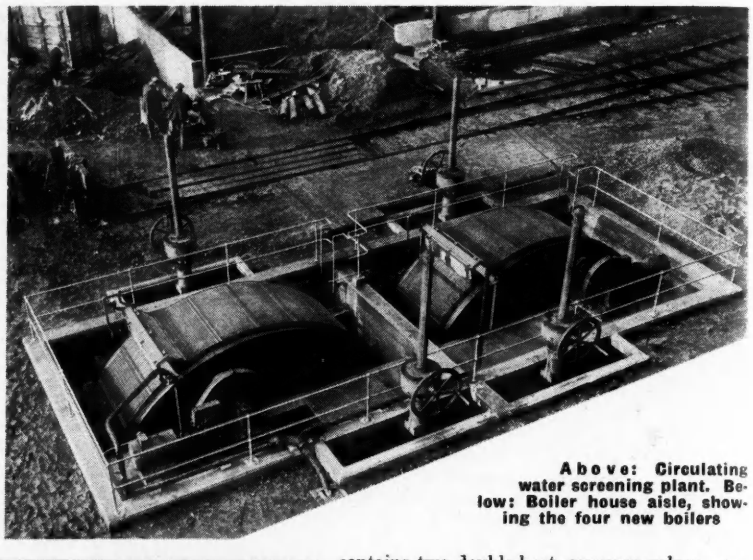
points), steam- and water-flow, superheater-temperature and smoke indicators. Temperatures at various parts of the boiler can also be ascertained by turning a rotary switch.

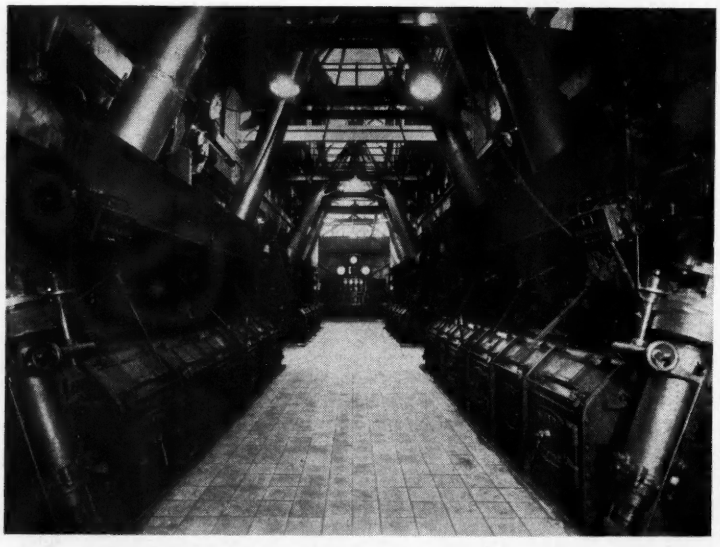
Control apparatus includes push-buttons with ammeters and raise and lower switches for the i.d. and f.d. fans, together with the stoker and superheater regulators. Alternative manual control is also provided for the fan vanes and for the superheater temperatures. Permanent records of variations in conditions affecting each boiler are given on diagram recorders and counters mounted on a master panel housed in a separate recorder room.

A complete system of automatic boiler control operating on the electrical impulse system has been installed. The positions of the damper vanes on the induced- and forced-draught fans are varied with the steam pressure, the controller assessing the rate of change as well as the deviation from the mean value, thus obviating hunting. The arrangement is designed to preserve balanced draught in the combustion chamber with load changes.

Fuel supply is governed by altering the speed of the stoker motors. Signals sent out by the controller when the ratio of fuel to air deviates from the most efficient value are picked up by a small motor mechanically connected to the shunt-regulators of the stoker motors. A master controller that governs all four boilers is situated in the recorder room, but the controllers for furnace pressure and fuel-air ratio, together with CO_2 recorders and stoker-motor regulators are mounted on panels placed alongside these boilers.

Make-up water is provided by a lime-soda softener with an output of 2,400 gal. per hr. and an independent steam-heat evaporator. Before passing to the feed system the softened water is distilled in a triple-effect evaporator, which receives the heating steam for the first effect from the h.p. steam range, and is pumped to the suction line of the boiler feed pump at





Above: Circulating water screening plant. Below: Boiler house aisle, showing the four new boilers

212 deg. F. The output is 15,000 gal. per hr. at 212 deg. F.

Three feed pumps have been installed, each capable of delivering 300,000 lb. of water per hr. at 210 deg. F. against 900 lb. per sq. in., the pressure varying by less than 10 per cent. between no load and full load. Two pumps are driven by 510-h.p., 3.3-kV squirrel-cage motors with automatic-contactor auto-transformer starters. The third pump is driven by a single-stage impulse steam turbine which automatically comes into operation in the event of low pressure in the feed main.

The old scraper-conveyor ash-handling plant has been replaced by a system incorporating concrete air-tight sluice troughs running the whole length of the old and new boiler houses and discharging into a sump holding 100 tons of ashes. Thence the water passes to underground pumps which deliver 1,750 gal. per min. to the far end of the troughs under the boilers. Two overhead telphers grab the ashes from the sump and convey them to two reinforced concrete bunkers having a combined capacity of 240 tons.

Steam from the boiler house is taken to a solid forged steam receiver drum and thence to the turbine. The cast-steel valves on the receiver are electrically operated from a central cubicle containing a mimic diagram of the steam system. "Corwel" joints are included in the pipes that convey feed water at 900 lb. per sq. in. from the feed pumps in the turbine room to the boilers as well as in the h.p. steam pipes.

The turbine, of the reaction type, has a maximum continuous rating of 30,000 kW, its most economical load being 24,000 kW. Steam is admitted to the h.p. cylinder by two inlet belts through branches in both its top and bottom and is expanded from 650 lb. per sq. in. to atmospheric pressure before being led to the centre of the tandem l.p. cylinder through which it flows axially to twin exhausts. The blades throughout are of stainless iron and those at the exhaust end are protected from erosion by tungsten-steel shields. Except for the exhaust portion, the h.p. cylinder is of molybdenum steel, as is also the steam chest, which is placed alongside the turbine and contains two double-beat governor valves, controlled by oil relays, and a runaway valve.

The body of the h.p. spindle is a hollow forged drum, integral with the shaft at the h.p. end and closed by a forging extended to form the other shaft end. As the thickness of the walls of the drum is comparable with that of the cylinder, working clearances are not appreciably altered by differential expansion. The l.p. spindle is built up by shrinking forged steel discs on a central shaft. Motor-driven turning gear is provided to secure uniform cooling or heating of the rotors when shutting down or starting up the set.

A dual-flow surface condenser, with a cooling surface of 25,000 sq. ft., maintains a vacuum of 29 in. (bar 30 in.) at the most economical load. Two vertical centrifugal pumps, situated below the lowest tide level, can deliver 18,000 gal. of cooling water per min. each when working separately or 24,000 gal. when in parallel. These are driven by 135-h.p. 3.3-kV motors started by direct switching on to the line. A new circulating-water culvert, 16 by 18 ft. and 675 ft. long was constructed to replace the original culvert. It is capable of dealing with 6 million gal. per hr. at a ratio and flow of 2.5 ft. per sec. A new chlorinating plant has also been installed.

A three-stage steam-jet air extractor, using the main condensate as for cooling, exhausts into a feed-water heater at each stage, and duplicate single-stage vertical condensate extractor pumps are included in the equipment. The condensate is progressively heated to 310 deg. F. (at economic rating) in two l.p. and two h.p. stages by steam bled from the turbine at four points.

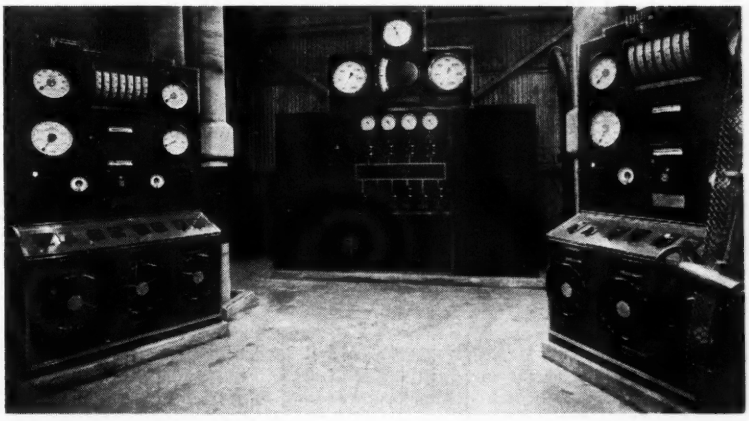
The stator of the 37,500-kVA 6.6-kV, 3,000-r.p.m. alternator is built up of electrically welded mild steel plates and bars. Its windings are formed of stranded coreless cable, in which individual wires are insulated and spiralled in a definite lay to avoid eddy-current losses. For the same reason the end shields are of non-magnetic and non-conducting material, which is said to be only one-fifth the weight of ordinary metal shields. The rotor is a single mild-steel forging. A direct coupled exciter (itself excited by an auxilary generator) supplies the alternator field. Ventilation is on the multiple-inlet enclosed system by two 110-h.p. fans, one of which is

enough at the most economic rating. The exciters and slip-rings are totally enclosed and cooled from the main air circuit.

Protection by the Merz-Price circulating-current and negative phase-sequence systems is employed. Overload protection is available, but is not normally in commission. The former iron-grid station earthing resistance has now been superseded by two of the liquid type in parallel, each of 2.2 ohms and 1,750-A capacity.

The main 6.6-kV switchgear for the new plant is of the duplicate bus-bar stonewall-cubicle type and comprises six 1,000,000 kVA units, one 500,000-kVA unit and an extension of the existing 500-000-kVA bus-bars.

For the heavier-duty type there are three of 3,000-A for two grid transformers



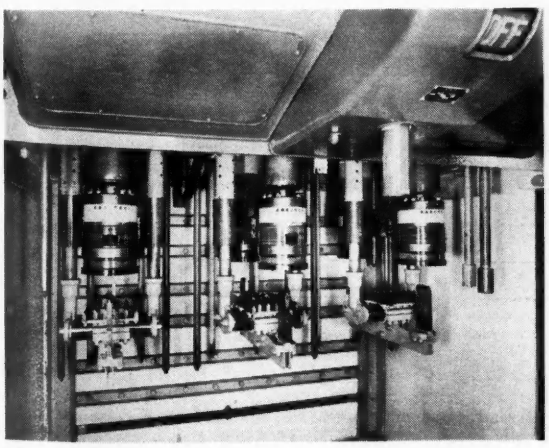
Boiler instrument panels and receiver valve remote control panel with mimic diagram of steam valves and pipes

and one reactor and three of 4,000-A for the alternators, bus-bar coupling and sectioning equipments. Bus-bar selection is obtained by isolators operated by an external hand wheel through worm gear. A manual earthing isolator is also provided; this can be operated only when the cubicle doors are locked. Conductors, which are supported on porcelain insulators and insulated with bakelised paper in certain cases, are all tubular, 4½ in. external diameter (different sectional areas being obtained by varying the thickness of the tube) with internally grooved muff-couplings for right-angle bends and tee joints.

The 1,000,000-kVA circuit-breakers consist of a double-pole unit per phase mounted on a solid top plate; each phase is in an oval "Elephantide"-lined steel tank, as the adoption of 7 ft. 6 in. for equipment centres precluded the use of round tanks. Tungsten-coated steel is used for the arcing contacts, which are in a horn-fibre explosion pot. Under the tanks are oil sumps filled with pebbles and drained to a 2,000-gal. sump outside the building. Current transformers are of the porcelain insulated straight-through type.

The 500,000-kVA switchgear is generally similar in layout but the contacts of all three phases are in a single round tank. Between the million and the half-million kVA boards is a 15,000-kVA reactor in concrete having a reactance of 5 per cent. The voltage regulator is of the rheostatic type. Armouring of the multicore coated cables is insulated from earth except at the end in the vicinity of high voltage conductors. All circuit-breakers are remote-electrically operated from the control room.

For supplying the auxiliaries three 6.6/3.3-kV 2,000-kVA outdoor-type transformers without tappings have been housed in cubicles under the switch annexe and open to the river front. The 3.3-kV supply is taken to a twelve-panel metal-clad compound-filled switchboard, from which the feed-pump and circulating pump motors are fed direct. All other a.c.



Contacts of the new 1,000,000-kVA switchgear

auxiliaries are supplied through three 750-kVA 3.3/400/230-V transformers, installed in the base of the new chimney, *via* a metal-clad air-insulated switchboard in the boiler-house annexe. Each boiler auxiliary board which is on the fan floor and remote operated from the firing floor, is fed through a 1,000-A circuit breaker and a pair of 0.3 sq. in. armoured cables.

Fire-extinguishing apparatus on the "Mulsifyre" principle (high-pressure water spray) has been installed as the primary precaution everywhere except in the switch rooms, where an automatic CO_2 system of forty-eight 80-lb. cylinders has been adopted, with "Mulsifyre" as a hand-controlled secondary measure. Duplicate pumps for the latter, one electric and one steam, are situated in widely separated partitions. Sectionalising walls of steel-covered asbestos have been erected in the switch room.

The main contractors included the Stirling Boiler Co., Ltd., boiler plant; C. A. Parsons & Co., Ltd., turbine and condensing plant; General Electric Co., Ltd., 1,000,000-kVA switchgear. As sub-contractors to the above were Aiton & Co., pipework; Arca Regulators, de-superheater and reducer; F. W. Brackett & Co., circulating water screens; British Insulated Cables, l.c. cables; British Thomson-Houston Co., 500,000 kVA switch and bus-bar extension; Brookhirst Switchgear, motor starters; Chemical & Insulating Co., lagging; Cope's Regulators, feed regulators; Durasteel Roofs, fireproof partitions; English Electric Co., 400-V switch-fuse distribution boards; James Gordon and Co., CO_2 instruments; E. Green & Son, Foster economisers; Hopkinsons, valves; James Howden & Co., Turbovane fans and air-heaters; International Combustion, L-type mechanical stokers; George Kent, instruments and automatic control; Walter Kidde, CO_2 fire extinguishers; Laurence, Scott & Electromotors, motors; Mather & Platt, feed and circulating pumps and "Mulsifyre" fire extinguishers; Metropolitan-Vickers Electrical Co., auxiliary transformers; Neckar Water Softener Co., water treatment plant; P. & B. Evaporators, evaporator; Paterson Engineering Co., chlorinating plant; A. Reyrolle and Co., 3.3-kV and 400-V auxiliary switchgear; Stevensons, ash-handling plant; Allen West and Co., motor starters.

The design of the extension was carried out to the plans and specification of Mr. V. A. Pask, city electrical engineer.

Electrical Engineering at University College

THE annual report of University College, London, contains imposing statistics relative to the number of students, from fifty-four countries, and their activities. Last year's benefactions included £3,000 from Miss Mary Clinton for the endowment of a prize in electrical engineering and the institution of an electrical engineering apparatus and equipment fund, in memory of her brother, the late Prof. Wellesley Curram Clinton, who occupied the Pender chair of electrical engineering at the College from 1926 to 1934, and had been a member of the Department of Electrical Engineering for forty years. His successor is Prof. R. O. Kapp, who reports that there is a great demand for qualified electrical engineering students, the number of appointments offered being in excess of the available candidates. The equipment of the electrical engineering laboratory has been augmented by the purchase of a single generator capable of giving high-frequency currents varying from 9.8 kilocycles to 30 megacycles with constant voltage output, and the construction in the department of a potential transformer of special design, to enable low voltages and powers to be measured with standard instruments. Researches, mostly conducted with assistance from industry, have included a protective device for the automatic disconnection on short-circuit of discharge-tubes as used for lighting and advertising signs; the development of an electrostatic voltmeter, using a liquid dielectric of high dielectric constant, resulting in an instrument with some nine times the sensitivity of any electrostatic voltmeter at present available; the cause of noise produced by transformers, this work being done in close association with the National Physical Laboratory; the precise measurement of magneto-striction on iron alloys; the effect of angle of incidence of primary electrons on secondary emissions; and the behaviour of nickel-iron alloys carrying ultra-high frequency magnetic flux.

Turbine Operating Costs

By G. O. McLean, M.Eng., A.M.I.E.E.

The effect on capital and running charges of steam conditions and of sizes and types of plant are dealt with

Of the five hundred-odd million pounds of capital expended in electricity supply as a whole generation is responsible for about 30 per cent., against 48 per cent. for distribution and 22 per cent. for other expenses. Generation costs consist of two parts—fixed and running—and can conveniently be expressed as

$$£\left(\frac{x}{\text{kW capacity}}\right)+\left(\frac{y}{\text{kWh generated}}\right)\text{pence.}$$

Owing to the different amortisation rates, generation's proportion of the *annual* capital charges is raised to 40 per cent. of the total; approximately the same figure holds for generation's share of the annual working expenses (excluding capital). The Electricity Commissioners' returns also show the proportion of annual capital charges to running costs for generation to be as 47 is to 53. During the last ten years generation costs have been falling as a percentage of the total, while the capital charges part of generation costs have been rising mainly because running costs are being reduced.

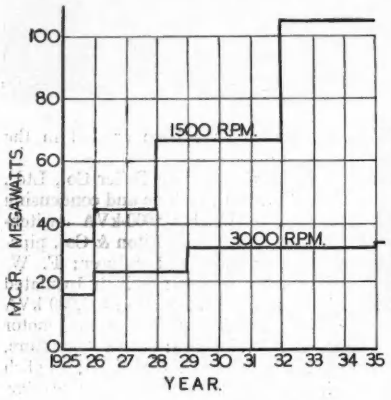


Fig. 1.—Trend of maximum size.

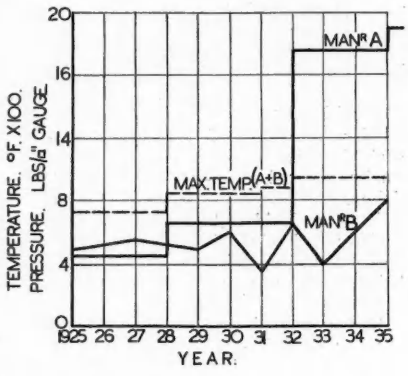


Fig. 2.—Trend of steam conditions.

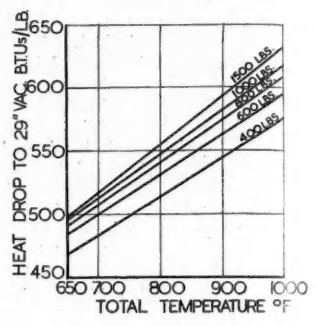


Fig. 3.—Adiabatic heat drop and temperature at various pressures (from Callendar's tables)

Some years ago two papers* were read on the economic value of high steam pressures, and though 200 lb. per sq. in. and 700 deg. F. condition was taken as the basis for comparison, the calculations, graphs and conclusions contained therein still repay careful study. It was postulated in the first paper that the influence of higher pressure was to increase the thermal efficiency (for turbine cycle only) rapidly up to 1,000 lb. per sq. in. (41 per cent.) and thereafter much more slowly up to 2,000 lb. per sq. in., the further gain being only 1 per cent.

The effect of raising the initial temperature at pressures up to 1,500 lb. per sq. in. is to cause a steady increase in thermal efficiency. This was demonstrated in practice in 1933 by running the 1,000-deg. F. machine at Delray at various steam temperatures from 700 to 1,000 deg., when the heat consumption results showed a steady drop at all loads.† This is seen in fig. 3, which shows the available heat drop at various pressures and temperatures down to a 29 in. vacuum. It will be noticed from these curves that the pressure lines get closer together, and therefore large increments are necessary at pressures which are in use to-day to secure any appreciable gain in heat drop, which in turn governs turbine thermal efficiency.

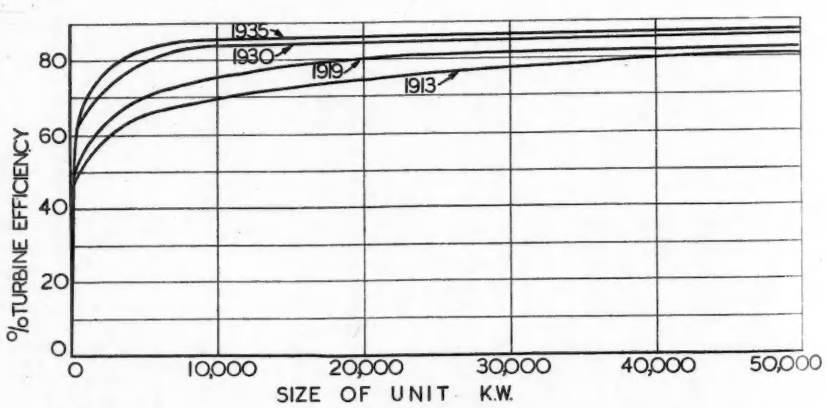


Fig. 4.—Output and turbine efficiency

Turbine efficiency ratio has altered very little in the past few years, and is also only very slightly affected by size (see fig. 4), which implies that it is quite as practicable to get a good little machine as a good big one. Gains in overall thermal efficiency have been due mainly to developments in the steam cycle. Ignoring binary cycles (the development of which has been left to the United States), the choice lies between the straight regenerative cycle and a reheating cycle. The latter was introduced at the time when higher pressures were being used and steam temperatures of 700 to 750 deg. F. were looked upon as the maximum.

British turbine designers aim at limiting the water content of the exhaust steam to about 12 per cent., and Guy states that steam at 1,200 lb. per sq. in. and 750 deg. expanded down to 29 in. vacuum would have 20.3 per cent. water on leaving the last blades. He then shows that reheating once to the initial temperature gives a theoretical gain in thermal efficiency of 8 per cent. In practice, however, this figure is reduced to about 5 per cent., and then the increased capital charges due to special reheat boilers and additional space required (involving building costs) load the scale against the cycle.

This does not mean that reheating is wholly condemned (Dunston B is a modern station operating efficiently on this cycle), but the metallurgist by providing metals reasonably safe to operate with steam temperatures of 850 to 900 deg. F. has minimised the necessity for reheating. Initial pressures of 800 lb. per sq. in. can be used when superheated to 850 deg. without reheating, and erosion troubles at the exhaust end of the machine (especially with tipped blades) are negligible. The use of higher steam pressures, however, invariably precedes advances in temperature, and as capital costs for high-pressure turbines are reduced as they pass out of the experimental stage reheating becomes worth while.

Turning to the straight cycle of turbine condenser-boiler, development here has been in the degree of regeneration. By that is meant the extent to which the steam is tapped to raise the temperature of the condensate, instead of total rejection to the condenser. Much has already been written‡ on the sub-

* Mellanby & Kerr, I.Mech.E., 1927. Guy, I.Mech.E., 1927.

† See Trans. A.S.M.E. 1934—Papers by Carter and Ellenwood; and Thomson and Van Duyer.

‡ (Guy—loc. cit.; Baumann, I.Mech.E., 1930, etc.).

ject of the economic feed temperature, and the question is still a live debating point. It is, however, admirably

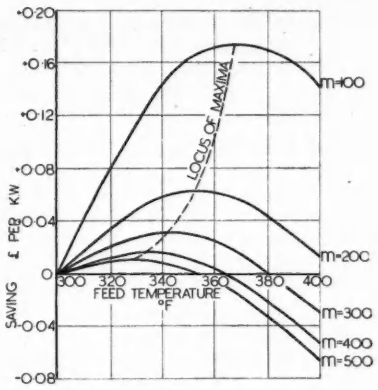


Fig. 5.—Variation in economy with feed temperature

summed up by fig. 5,* (the economic feed temperature). This was constructed after due consideration had been given to sizes and prices of air heaters, economisers, boilers, feed heaters, steam pipework and condensing plant; while capital charges, plant load factor and the economic and thermal value of the fuel are taken care of by the factor "m," which is expressed by $m=b/c\times r/l$, where b=calorific value of coal in B.th.u. per lb., c=coal cost in shillings per ton, r=capital charges per cent., and l=plant load factor per cent.

Certain assumptions were made regarding the relative costs of different items of plant and their variation with higher temperatures. These assumptions were not challenged at the time and, though material and labour costs have risen since then, the principles remain unchanged and the shapes of the various preliminary and final curves presented by the authors still hold for whatever initial pressure and temperature is taken as a basis.

There is a progressive rise in economic gain with feed temperatures and load factor, which is the main variable in the factor "m." This characteristic is further intensified if the additional economiser and air heater surface can be minimised, and therefore it is surprising that there have not been more developments on the lines of, and because of, the paper and discussion on what are usually called "Thermal-Electric Stations." †

As regards turbines the gains from high feed temperatures in both capital and running expenses are considerable. Exhaust conditions are affected by the water content of the steam entering the condenser and the decrease in size of the latter with increase in the degree of regenerative feed heating. Despite special wells and traps and the expected advantage of centrifugal force, "bleeding" at several points does not *per se* materially reduce the water content leaving the last row of blading. Guy holds that 80 per cent. is in the form of mist and does not reach the periphery of the blading.

The effect on condenser sizes will be best realised from a consideration of the exhaust-end blading the area of which is nowadays only 75 to 80 per cent. of that required without "bleeding." Sir Leonard Pearce, at the Oxford Summer School, 1934, summarised the position by saying that it was now only necessary for the condenser to deal with 700 instead of 1,000 B.th.u. for each pound of steam entering the turbine; and modern designs of condensers allow a vacuum corresponding to the circulating water inlet plus 20 deg. F. to be obtained when using 50 gal. per hour per kW m.c.r. and cooling surface of 1 sq. ft. per kW.

Economically there is not much choice since conditions are more or less fixed by the initial steam conditions, turbine efficiency and the amount of feed heating. Recent research and developments in condenser design have had in view a further reduction of cooling surface and also an increase in the regenerative factor in the condenser itself, so that the condensate temperature on leaving it may approach the exhaust temperature.

The figures quoted above for the main condenser characteristics are quite conservative, and, for comparison, the 30,000-kW turbo-alternator recently installed at Hull can be taken as an average for

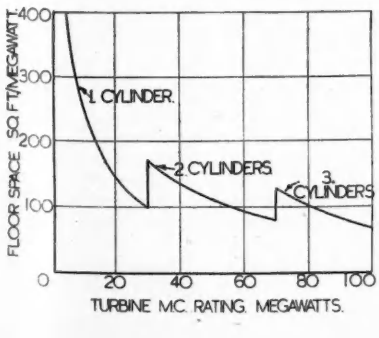


Fig. 6.—Average floor space taken by turbines

medium-sized machines working under conditions somewhat below the average (400 lb., 800 deg. F. and final condensate 300 deg. F.). The condenser has 0.8 sq. ft. per kW m.c.r., and when using 40 gal. per hr. per kW a vacuum corresponding to 22 deg. above circulating water inlet temperature is guaranteed.

It is to be noted that overall heat transfer rates of 500 to 700 B.th.u. per sq. ft. per 1 deg. F. difference (steam to water) per hr., with average water velocities and temperatures, are in regular use by condenser designers; while on the regenerative side condensate temperatures within 1 or 2 deg. of the steam inlet are regularly obtained, and temperatures of 5 deg. in excess of vacuum temperature have been observed.‡

It is uneconomic to raise capital costs by virtually specifying a larger condenser than is necessary through allowing margins on all the data given to the designer. This is sometimes done by adding several degrees to the mean water temperature in the hope that better vacua results than those guaranteed will be obtained; or adding an extra 0.1 in. Hg. to the actual vacuum desired to allow for contingencies such as designer's errors, higher water temperatures or condenser fouling. The designer will make all the allowances necessary and would prefer the specification to be open regarding water quantities and surface areas. The generating engineer is concerned with the heat consumption of the whole unit and the total cost to obtain the lowest practicable consumption.

Size does not appreciably affect efficiency, which is another way of saying the running costs since approximately 60 per cent. of these are for fuel. Capital costs vary inversely with the size of plant, though specifications are so diverse that it is difficult to draw comparisons from published prices. Generally speaking, for similar and average conditions the price per kW m.c.r., complete with all auxiliaries and including erection for a 30,000-kW set, is generally about 12 to 15 per cent. less than a 15,000-kW set; while for a 50,000-kW machine it is a further 12 to 15 per cent. less; and for a 100,000-kW machine another 10 per cent. less—a round figure with present prices for the 15,000-kW machine being £4 5s. per kW. From

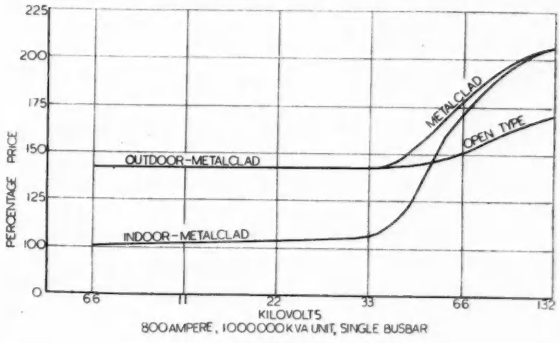


Fig. 7.—Switchgear prices

this it would appear desirable to look well ahead and install machines large enough to carry, say, half the station peak load; but this must be considered with regard to actual and anticipated load factors.

The advent of the Central Electricity Board has done a great deal to increase individual plant load factors, but is not the plant becoming obsolete at a quicker rate so that if the sinking fund and interest charges are taken at 7 per cent. and 3 per cent. (equivalent to a useful life of eleven years) the load factor over such a useful life, which is what really matters, is lowered?

I believe that not enough attention is paid to the importance of load factor in relation to generation costs. The operation engineer, familiar with Parsons lines and the variation of shift coal figures with load, knows the effect of load factor on efficiencies and hence on running costs; but it has an equal if not bigger effect on capital charges, as the economic goal is to keep every £ of capital usefully and continuously employed at economic ratings, *e.g.*, by offering tempting off-peak tariffs.

Site and Building Costs

The variation of capital costs with size, however, does not include building costs, and on this item the odds are all in favour of larger machines. The Commissioners' analysis of capital expenditure reveals that generation building costs form 31 per cent. of the total generation capital, while a more usual assumed figure for building is 25 per cent. of total costs or 33 per cent. of plant costs. Each case will depend on land conditions and local building rates. In the north these are low

* (Reproduced from Baumann's paper).

† "Industrial, Agricultural and Domestic Heating with Electricity as a By-product," by S. B. Donkin (Proc. Inst.C.E., 1936).

‡ Guy & Winstanley, I.Mech.E., 1934.

and I know of one instance in which generation building costs are only 18 per cent. of the total generation capital.

Numerous cases could be cited of large modern machines being erected on sites occupied by old machines one-quarter or one-fifth their size (a 25,000-kW machine replaced a 5,000-kW set at Hull in 1935) to show the effect of reduced floor space due to the use of higher pressures and temperatures. For similar steam conditions, moreover, the area per kW capacity decreases as size increases, though there are steps at the changes in the number of cylinders, and fig. 6 is an attempt to show this in the form of a graph by plotting numerous installation figures.

The American way of making these steps favourable instead of retrograde is "steeple compounding," or putting the h.p. cylinder on top of the l.p. cylinder; where land is expensive and building costs abnormally high this would appear to be justified despite disadvantages in inspection and maintenance work. Nevertheless, even with a 25 per cent. proportion for buildings, considerable savings are made by installing the largest machine the projected load and load factor will stand, especially since a great deal can be achieved with the latter by means of a progressive sales policy.

Generator Voltage and Switchgear

Generation *voltage* also affects capital costs. All switching is nowadays carried out at the local transmission voltage, which generally does not exceed 33 kV. The reliability of generators working at this voltage is established, and since the capital cost for such machines (turbines and alternators) is only from 3 to 4 per cent. higher than for 6.6 and 11-kV turbo-alternators, there is a saving over the use of the latter with unit transformers of about 10 per cent. of the total turbo-alternator cost before buildings are considered; generation at local transmission voltage is therefore strongly to be advocated.

It has been argued that since transformers are required to step up to the grid voltages of 66 and 132 kV, these transformers should form part of the generator equipment and the main bus-bars and that all switching should be carried out at such voltages. This may be ideal where a local transmission network is operated at the same voltage as the grid when the generator can be loaded independently of the grid. It is impracticable where the generating station is also the distributing centre for high-voltage supplies, as switches and bus-bars are necessary at the distribution voltage.

The economic primary voltage for generation and the main network for supply areas of over 50 sq. miles is about 33 kV. The price of switchgear rises sharply above this figure, a circuit-breaker of the same rating costing twice as much at

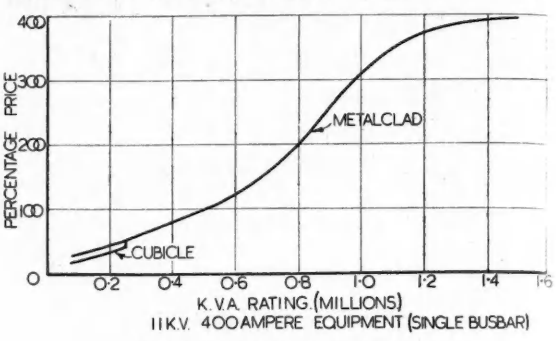


Fig. 8.—Rupturing capacity and price

132 kV as at 33 kV. A small-sized switch at a low but standard transmission voltage has been taken as the basis for price variation in fig. 7, as it is frequently met with in distribution work in this country and actual monetary values can easily be added from one's own experience. A fair average figure for 11-kV switchgear for a 30,000-kW set is 3 per cent. of the complete turbo-alternator price.

Switchgear prices, however, are not only dependent on voltage and type and make. The generator sizes, their characteristics, the number, sizes and circuit connections of reactances, and the general electrical characteristics of the whole system all have a bearing on the possible fault currents and so dictate the rupturing capacity. Fig. 8 has, therefore, been prepared to show the variation of switchgear price with rupturing capacity, which up to and including 33 kV influences price more than anything else.

Building costs have not been included in the diagrams, since makes and types cause some variation in size and style of building required. A rough approximation is one-third the size (cubical contents) of the turbine house, where the station is also the main distributing centre.

The Empire Exhibition. By W. Cruickshank

Lighting arrangements at Bellahouston Park

WHEN the Empire Exhibition authorities obtained the permission of the Glasgow Corporation to build their show in Bellahouston Park they had chosen their site wisely. Situated along the main road to Paisley, with a fine residential district behind and not far from the busy shipbuilding yards on the Clyde, the park lends itself admirably for the lay-out of the buildings, boulevards and terraces which even at this early date bid fair to outrival Wembley as an Empire showground.

The exhibition proper lies on the comparatively flat ground surrounding the wooded hill rising in an elongated oval in the centre of the park. On the top of the hill two main structures have been erected—one, the Tait Tower, about 250 ft. high, and the other, the Atlantic Restaurant, built like a ship with its bows pointing "doon the water" in the direction of Clydebank, where in John Brown's yard the hull of the new mighty *Queen Elizabeth* is rapidly assuming its ultimate shape. At the base of the tower another restaurant has been built round the tree trunks and if the weather keeps smiling the diners will take their ease in sylvan surroundings with the lower Clyde valley spread out below them.

The lighting arrangements have progressed far enough for one to form a good idea of the final effects. The Corporation will supply the power which will be distributed from ten substations. It is expected that a supply of 1,000,000 kWh per month will be required during the period of the exhibition, from May to the end of October, and the plant to be installed will be equal to that supplying a normal city of 500,000 inhabitants. Over 13 miles of main underground cable have been buried and 240 miles of wiring have already been completed. In addition to this the Post Office telephone authorities have laid down a network for an exchange of 800 lines, with some 50 kiosks and junction circuits to the local and trunk exchanges. In the Palace of Engineering, which is practically completed, over 25 miles of cabling are needed to meet the demands of the exhibitors.

The great developments that have taken place in neon tube lighting will be taken full advantage of in the direction of colour and floodlighting. The outlines of the main palaces and buildings will be picked out in colour and the names of the principal edifices will appear immediately daylight fades in illuminated coloured letters nine feet high. On the facade of the Palace of Industry, which faces down the main Dominions and Colonies Avenue, will be fitted a gigantic electric clock with its hands and hours brilliantly illuminated. In the centre of this avenue is an ornamental lake 400 ft. long, and this sheet of water will be floodlighted from below.

At the top of the tower three galleries have been erected on projecting girders from the central square and these galleries will be traced out at night in 3-ft. high bands of green, red and yellow lights. When illuminated, these broad bands of vivid colour will be visible fifty miles away.

An ambitious scheme of colour lighting is embodied in a duplicate system of waterfalls, the concrete frameworks of which have been erected on the north and south faces of the hill below the tower. The cascades are arranged in three sets of five and at every fifth fall a 30-foot pylon has been raised for illumination purposes. The colours on these pylons will change every five seconds, while behind the cascades themselves sets of 100-W lamps will glow in four colours. The combination of the flashing lights on the pylons and the coloured lights glowing through the falling waters will produce a spectacle which has never been equalled in this country. Broad flights of steps lead up the hill on both sides of the waterfalls. At the tail races sunk power houses are being built which will contain the pumping machinery for raising the water to the hill-top for use again and again.

The trees on the hill and throughout the grounds will be floodlighted in many colours, while festoons of coloured lights will be slung between the specially designed steel flagpoles which will line the main avenues. Spotlights will play on the flags of Empire to be flown from the various Dominion and Colonial buildings. During the long summer days of June and July, when natural light persists in these northern climes till about eleven o'clock, summer-time, the artificial lighting will, it is hoped, be not needed, but in the later months of opening, the illuminations will be in full operation and should prove even more attractive to the general public than the mellow glow of the summer evenings.

Concrete Poles in Rural Areas

Single-circuit 33-kV overhead lines

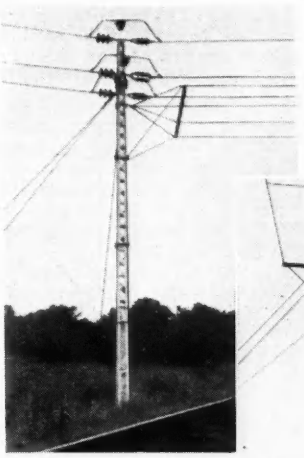
By John McCombe, Ph.D., A.R.T.C., A.M.I.E.E.

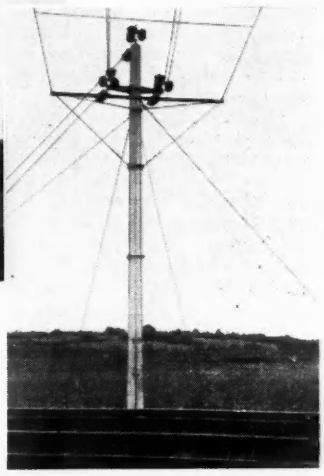
THE use of reinforced concrete poles in the construction of high-voltage overhead lines is rapidly increasing. Low cost of maintenance, simplicity of assembly, ease of erection and stability after erection are factors greatly in their favour. Secondly, the recent high price of steel and wood has assuredly put the cost factor on their side for 33-kV construction.

CONCRETE POLES FOR 33-kV SINGLE-CIRCUIT LINES.

Pole Type.	Where Used.	Range of Angles. deg.	No. of Stays.	No. and Type of Insulators.
Single standard (S.S.).	Straight - line positions.	0	0	3-pin, 1,000 lb.
Single standard (S.S.).	Small angles...	0–2	1-7/8 stay ...	3-pin, 1,000 lb.
Single standard angle (S.S.A.).	Small angles...	2–8	1-7/8 stay ...	3-pin, 2,000 lb.
Duplicate insulator light angle (L-A.).	Light angles...	8–20	2-7/8 stays ...	6-pin, 2,000 lb.
Single pole medium angle (S.M.).	Medium angles	20–40	2-7/8 'V' stays to one stay rod.	3-suspension-insulator sets.
Do. ...	Do. ...	40–50	2-19/10 stays	3-suspension-insulator sets.
Double pole section type angle (D.S.A.).	Angle... ...	0–8	1-7/8 stay ...	6-tension-insulator sets.
	Angle... ...	8–20	1-19/10 stay .	
	Angle... ...	20–50	1-19/10 stay and 2-7/8 stays.	" "
Double pole terminal (D.T.).	Terminal positions.	0	2-19/10 stays	3-tension-insulator sets.

There is no difficulty as to pole types, as the range is as wide as that of wood or steel. At the present moment all electrical firms are suffering from bad deliveries of all types of poles and steelwork. With concrete poles, however, the manufacture is usually carried out by the supplying contractor on site, so that supplies are greatly facilitated, and the accompanying schedule indicates the range of angles and positions over which they are used.





Cradle guards for protecting G.P.O. circuits

The straight-line pole is suitable for small angles up to 8 deg. without structural alterations except the addition of stays. At greater angles insulator spindles of the 2,000-lb. class are employed.

For light angles from 8 to 20 deg. two parallel cross-arms are braced together so that duplicate insulators can be fitted in tandem. Insulator spindles are of the 2,000-lb. type, and stays are fitted to take the pull due to the line diversion.

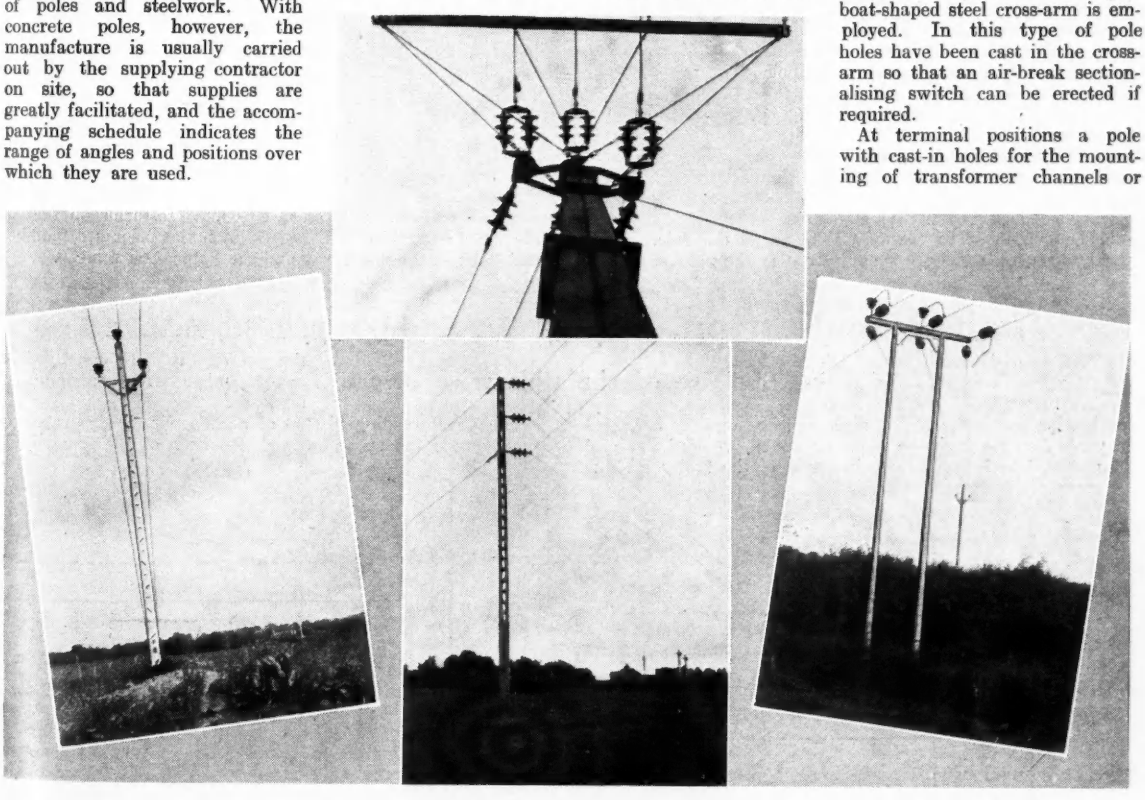
A pole suitable for angles of from 20 to 50 deg. has insulators of the suspension type. If the value of the angle is not greater than 40 deg. two 7/8 stays are fitted in a " V " arrangement, grounding to one stay rod. If, however, the angle is from 40 to 60 deg. two 19/10 parallel stays must be employed. It should be observed that this pole is placed out of line of route by a distance equal to the length of the insulator string. This is usually 2 ft. 3 in.

Where it is necessary to make a section point on a line a D.S.A. pole can be used up to angles of 50 deg. with the stays as given in the schedule. Should the angle exceed 50 deg. a boat-shaped steel cross-arm is employed. In this type of pole holes have been cast in the cross-arm so that an air-break sectionalising switch can be erected if required.

At terminal positions a pole with cast-in holes for the mounting of transformer channels or isolating switch or fuse gear is used. It is capable of taking full terminal loading with two 19/10 stays.

Where cradle guarding of G.P.O. circuits is required, special composite poles are used. The cross-arms and cradle guard fittings are of steel.

Stringing, binding and tensioning of the conductors on con-



Top centre: Arrangement of cross-arm and duplicate insulators on composite poles. Left: Straight-line pole. Centre: Single pole for medium angles. Right: Double pole for sectioning suitable for angles

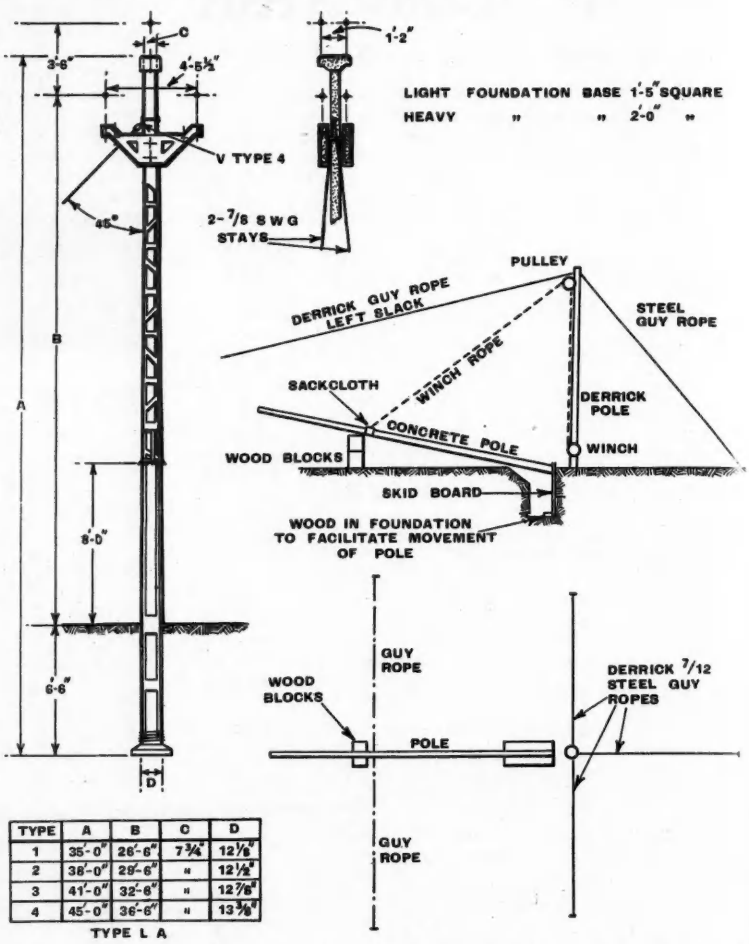
crete poles follow the general practice employed with wood or steel poles. I would, however, like to refer to the erection of the poles as this is where I have experienced most difficulty.

Bad handling, a wrongly fitted winch rope or mal-treatment can easily result in a fractured pole which is costly, and until a replacement is supplied may hold up the subsequent work on the section. The erection of concrete poles in somewhat different from that of wood poles. Their smooth surface precludes the use of ladders or pole pikes, and the additional weight makes handling more difficult.

The following method describes in detail how concrete poles may be erected at minimum cost and maximum safety.

The skid board is placed vertically at the back of the excavation. A piece of wood is usually laid at the bottom of the hole so that if any movement of the pole is required after erection it is facilitated by the smooth surface of the wood. The pole should be lying in line with the slot which has been made in the excavation. Incidentally, this slot should be in the direction of the line of route, though this is not always possible due to proximity of hedges, etc.

Left: Concrete LA, duplicate-insulator pole. (The dimensions are overall. Lengths of poles 3 in. shorter than "A." All holes $\frac{3}{16}$ in. dia., except insulator holes, which are $1\frac{1}{16}$ in.). Right: Method of erecting concrete poles



TYPE	A	B	C	D
1	35'-0"	26'-6"	7¾"	12⅛"
2	38'-0"	29'-6"	"	12⅛"
3	41'-0"	32'-6"	"	12⅞"
4	45'-0"	36'-6"	"	13⅜"

TYPE L A

The pole is then raised manually, pushed forward against the skid board and two large square wooden blocks put in to support it as shown. At the same time the derrick pole will be erected by the rest of the erection squad. This should be carefully guyed off by the 7/12 steel guy ropes fastened to anchor stubs driven into the ground. Where it is not possible to use the lorry for pulling up the pole the winch, which is incorporated in the derrick, is employed. The wire sling is then fixed to the pole at approximately two-thirds pole length from the butt.

Before fixing the wire sling the pole should be wrapped with a piece of sackcloth, as this prevents damage to the pole surface and also prevents the sling from slipping. The winch rope is then fitted to the wire sling round the pole. Two steadying hemp ropes are usually fixed to the pole so that in conjunction with the winch rope the pole can be easily plumbed after erection. Furthermore, a control can be exercised on the pole during erection, as in a heavy wind it is inclined to swing about.

Where double poles are required the erection procedure is the same; the poles are erected as two separate units and the concrete gates on the foundations and crossarms on the top are fitted after erection. On erection the poles are plumbed and lined in the usual way and the foundation reinstated.

Fault Localisation. By G. W. Stubbings, B.Sc., A.M.I.E.E.

The use of the slide wire bridge

THE provision of a second adjustable contact on a slide wire bridge used for fault localisation enables the fault position to be directly indicated in yards distance from the testing position, provided the total equivalent length of the loop in terms of the faulty cable is known. This convenience is obtained by so setting the second adjustable contact that a length of slide wire is used which corresponds in millimetres to the length in yards or simple multiples of yards of the cable loop. This convenience is of considerable importance in locating faults on distributor cables when the utmost speed is required, because it obviates the necessity for any kind of calculation and thereby avoids the possibility of error which may arise from arithmetical mistakes.

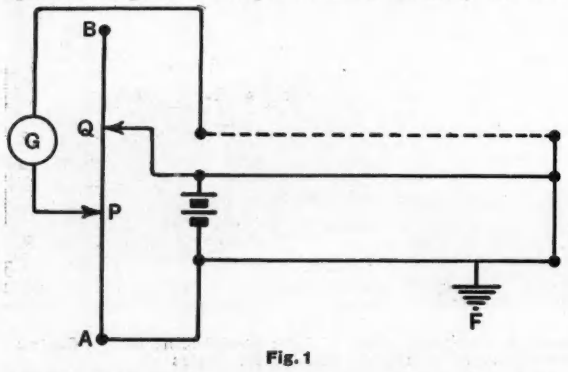


Fig. 1

The direct reading feature of a slide wire bridge is not of much use if the area of the cross-section of the sound cable of the loop is not known, and even if this area is known, the necessity for a calculation to determine the total equivalent length of the loop largely defeats the underlying idea of the direct reading device. If, in addition to a return cable to complete the testing loop, an additional conductor is available, the direct reading feature of a double contact slide wire bridge can be utilised without the necessity for any calculation, by

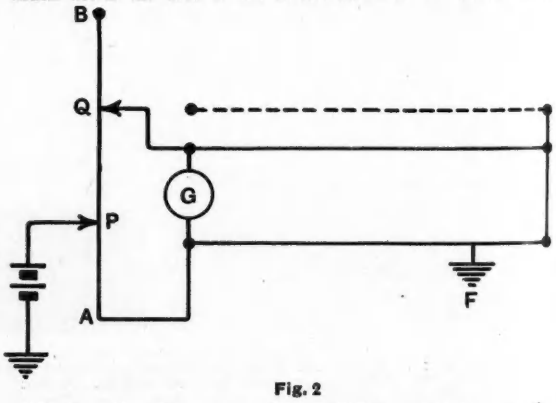


Fig. 2

New Lighting at the Old Bailey

Adaptation to architectural style

THE new electric lighting installation at the Central Criminal Court (the Old Bailey) provides a notable example of the results that can be achieved by relating a system of artificial illumination to the architectural character of its surroundings, without loss of power. In contrast with the original lighting system, which was installed in 1905, it shows how great has been the advance in the methods of providing artificial illumination.

In preparing the new scheme of lighting, the old system was entirely disregarded and each section of the building was considered separately in relation to its function, its form of decoration, and its predominating colour. Where architectural features or decorations are of sufficient distinction to merit special treatment, floodlighting or concealed cornice lighting have been installed bringing to view many hitherto unsuspected features of merit. A large number of fittings have been used and architectural lighting has been avoided where the surroundings do not lend themselves to such treatment.

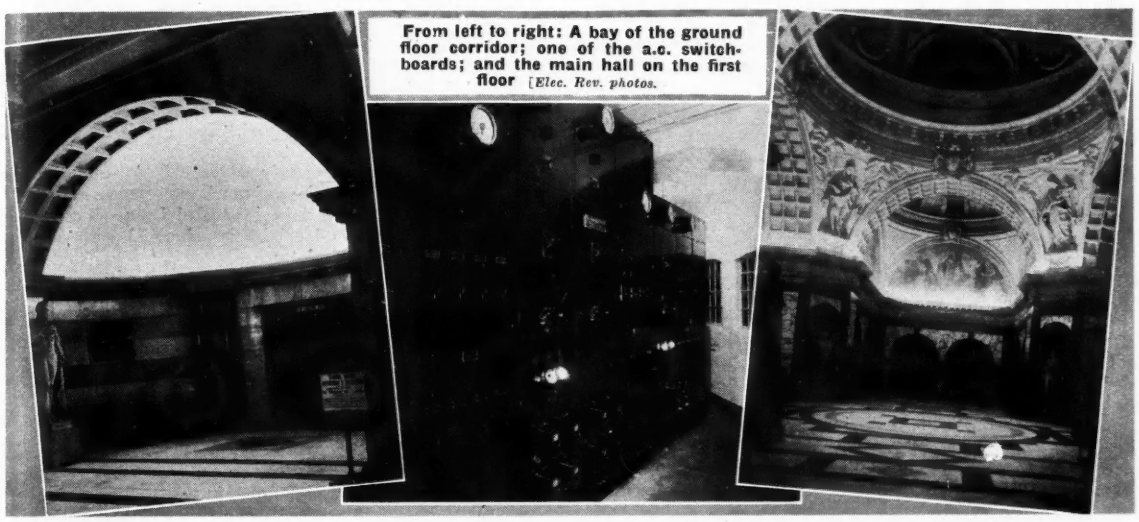
With a view to securing harmony with the architectural style of the building, together with good illumination, pleasing appearance and absence of glare, Mr. Gordon Spry (a partner in the firm of consultants) in conjunction with Mr. J. Seymour Lindsay designed fittings for 150 positions. The designs of most of the fittings were based on late eighteenth-century models of oil lamps, each suited to the decorative composition of its surroundings. The electric lamps are enclosed in pale pink glass globes, which, in combination with the bronze fittings, afford a general air of dignity.

The tonal values given to the lighting are particularly noticeable in the soft and restful illumination of the entrance halls and corridors on the ground and first floors, where combinations of direct, indirect, and panel lighting have been employed. In no case is the eye distracted by glare or a different tone of light. Outside the building, the figure of Justice and stone colonnade supporting the dome have been floodlighted.

In the basement, there are two sub-stations for receiving energy from the mains of the City of London Electric Lighting Co., Ltd. A single-phase a.c. service and a d.c. service from separate distributors have been taken into each sub-station at a voltage, in all cases, of 420-210, on a three-wire system. Normally, the a.c. switchboards, comprising nine and eight cubicle type panels respectively, are operated independently to serve separate parts of the building, but the busbars of each are capable of dealing with the entire load. The twelve d.c. circuits are controlled from one sub-station. Should the outside supply to one of the a.c. switchboards fail, selected circuits (*e.g.*, in the courts and cells) are automatically transferred to a 420-V lead-acid battery with a capacity of 200 Ah (ten-hour discharge rate) and, after a brief interval, the whole supply is taken *via* the other switchboard. In the event of a complete shut-down, the battery maintains the essential services.

In addition to the renewal of the lighting system, seventy-five 15-A points for electric fires have been installed, the telephone and bell circuits have been rewired, a fire-alarm system has been installed, and new control equipment has been provided for the refrigerating plant, pumps, fans and lifts. The whole of the machinery has been overhauled and reconditioned. A 12-V lead-acid battery, trickle-charged through a Westinghouse rectifier, provides current for the communication and auxiliary services.

The renewal of the electrical system was started in the early autumn of 1936 and was recently completed without having caused any interference with the ordinary business of the courts. One of the most difficult tasks successfully performed was the cutting away and making good, and there is no evidence of disturbance to the elaborate decoration.



From left to right: A bay of the ground floor corridor; one of the a.c. switchboards; and the main hall on the first floor [*Elec. Rev. photos.*

The electrical contractors were F. H. Wheeler & Co., Ltd. Equipment was supplied by the following: J. Seymour Lindsay (specially designed electric light fittings); General Electric Co., Ltd. (striplights, floodlights, and all lamps); Johnson & Phillips, Ltd. (cables); Kartret Switchgear, Ltd. (main switchboards); D. P. Battery Co., Ltd. (batteries with charging motor generator and switchboard); Associated Fire Alarms, Ltd. (fire alarm system); Brookhirst Switchgear, Ltd. (motor control equipment). Messrs. Lucas & Pyke were retained as consulting engineers.

Fault Localisation (*Concluded from preceding page*)

making two separate tests. The area of the section of the third cable is immaterial, and it need only be a pilot or a telephone core, since it is used in the preliminary test merely as a galvanometer lead.

Fig. 1 shows the arrangement for the preliminary test. Here AB is the slide wire and P and Q are the adjustable contacts. The cable loop which forms part of the Wheatstone bridge network is shown in full lines; the third pilot conductor is shown dotted. The adjustable contact P is set to such a position that the distance AP along the slide wire in millimetres corresponds to the known length of the faulty cable in yards or a simple multiple of yards. The second adjustable contact Q is then adjusted so that the galvanometer deflection is zero. When this condition obtains, the distance PQ on the slide wire has the same ratio to the distance AP as the unknown equivalent length of the sound cable of the loop has to the length of the faulty cable. Thus, the distance AQ in millimetres is equal to the equivalent length of the complete cable loop in yards.

Changing over the connection to the arrangement shown in fig. 2, the contact Q is untouched, while the contact P is adjusted to obtain a second balance. When this second condition is satisfied, the length AP in millimetres gives the distance of the fault from the testing position in yards.

This double method of testing requires no calculation, and it is much superior in accuracy to the single method of testing sometimes advocated in which the third conductor forms part of one of the slide wire arms of the Wheatstone bridge. With this single test, serious errors can occur, unless the resistance of the third conductor is negligible in comparison with that of the slide wire. Even if the ratio of the unequal cross sections of the faulty and sound cables of the loop is known accurately, a simple calculation in uncomfortable conditions can give rise to the risk of a mistake, whereas errors are hardly likely to arise in the field with null methods of testing.

Again the Boiling Plate

By L. V. Turner, A.M.I.E.E. *

CONSIDERABLE interest seems to be centreing around the boiling plate again, and it would appear from the many letters and articles which have been written that no person takes tests or makes statements with which we all agree. I notice in one article it is stated that the radiant-type plate provides no contact between the element and the utensil. Is this correct?†

In another case, when efficiency tests were given they were apparently taken with an average of one, two, three and four pints of water. Now, this is, of course, misleading, as some hot plates, such as the radiant type, boil small quantities of water quickly, while others, such as the solid hot plate, take longer for small quantities. Therefore, the efficiency should be stated for a definite quantity of water, if, indeed, it should be stated at all. Personally, I consider it wrong to take efficiency as a standard by which to judge a boiling plate, because the difference in efficiency between any of them is not such as to make it of much account, and it varies very considerably with the type, life and usage. Electric boiling has in the past been criticised by the public as being slow and not as inefficient, and it is therefore the former impression that we should attempt to remove from the minds of users.

Again, reliability is probably of greater importance than efficiency, both from the point of view of the consumer and also of the supply engineer, who is vitally concerned with maintenance costs, a point which I note is seldom mentioned. I have had experience with a variety of hot plates in an undertaking which has increased its cooker output during the past twelve months by over 100 per cent., and I know that the cheapest to install is often by far the most expensive in the long run.

Type of Plate.	One Pint.			Two Pints.			Three Pints.		
	Time. Min. Sec.	kWh.	Efficiency, per cent.	Time. Min. Sec.	kWh.	Efficiency, per cent.	Time. Min. Sec.	kWh.	Efficiency, per cent.
Solid... ...	7 29	0.269	21.8	9 30	0.349	32.9	11 24	0.399	43.8
Semi-radiant	5 54	0.161	35.7	9 5	0.265	43.4	11 44	0.341	50.6
Transformer-operated ...	3 54	0.172	34.0	6 28	0.295	39.0	8 25	0.375	46.0

The qualifications, therefore, to bear in mind are speed and reliability and cheapness of renewals when these are required. My experience is that the transformer-operated boiling plate fulfils these three essential conditions. From our tests we find it will boil small quantities of water more quickly than any other; it has a very strong psychological appeal, and costs approximately 4/6d. to renew, in the rare event of the failure of the resistor. Many of these have been out for more than five years without receiving any attention whatever. On the other hand, we have all had experience of the cracking, flaking and buckling boiling plate. In many cases the flat-bottomed utensils which the housewife has been advised to purchase finish up by touching in a few places only.

To return to efficiency, how can one compare boiling plates from this point of view? New plates do not remain so, and usually the tests which are published are taken when they are in this condition. I do not desire to underestimate the value of the enclosed boiling plate, but we should be aware of its limitations and consider carefully whether it is advisable to confine the consumer to one type of plate.

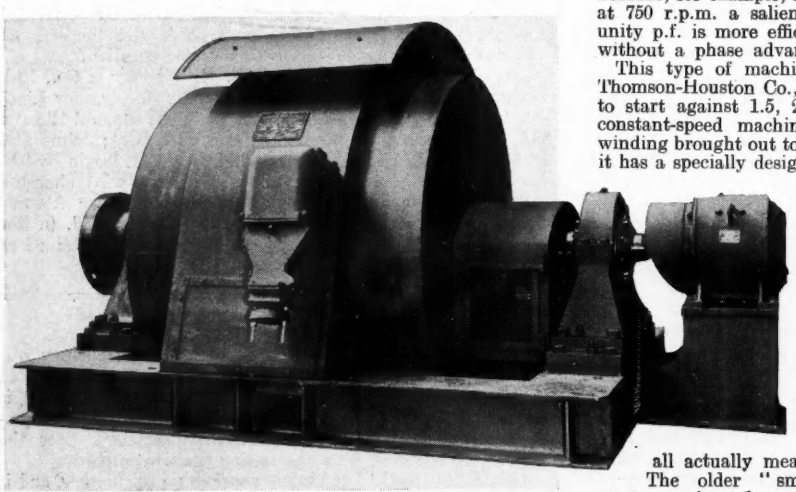
On the other hand, the transformer-operated plate does not fall in efficiency to any extent throughout its life. Its initial cost is more than that of the solid plate, but the charges are considerably less taken over the life of the cooker. Also, our experience shows that this plate, on account of its quick response to the switch, gets far more use than does the other type of plate. This has been particularly noted where cookers have been hired, each fitted with three different types of plates.

The day is past when the electric cooker could be looked upon as being the prerogative of the few, as every year finds us equipping with electric cookers, to an increasing degree, the homes of the working class, who quickly realise its many advantages. They, however, are compelled to study ways and means, and cannot be expected to scrap existing and purchase special utensils. If we are to enter these homes we should at least provide one hot plate that does not depend on special utensils for its speed. To my mind, hindrance to development has been caused by talk about the need for special utensils. It is a distinct advantage for a sales engineer when the consumer asks the inevitable question, "Do I have to buy special pans?" to be able to assure her that no special pans are necessary and that the cheapest tin or enamel ware will do.

With bright-bottomed utensils the speed of boiling can be increased by about 10 per cent. by giving them a coating of "Bastalite," which lasts a considerable time.

As previously stated, I do not consider efficiency alone of much importance, but for the benefit of those interested I append a table of speed and efficiencies obtained with different types of plates.

The table does not agree with those previously published, but, in the light of experience, can this be expected?



A B.T.H. 1,200-h.p. synchronous motor for a cement mill

Motor Efficiency

PURCHASERS are now paying more attention to operating efficiency over a period of time than they used to do. First cost is not the principal consideration when motors have to work almost continuously, such as those in flour and cement mills, which may have to run at or near full load for between 7,000 and 8,000 hours per annum (140 to 160 hours per week).

It is now beginning to be appreciated that in a large number of such cases synchronous motors can be used to advantage, not only because of their power-factor capabilities, but also because, for example, for a rating of more than about 500 h.p. at 750 r.p.m. a salient-pole synchronous motor operating at unity p.f. is more efficient than an induction motor, with or without a phase advancer.

This type of machine costs less to run, and the British Thomson-Houston Co., Ltd., designs its "Type AMT" motor to start against 1.5, 2 and 2.5 times full-load torque. This constant-speed machine has the usual three-phase starting winding brought out to slip rings on the rotor, but, in addition, it has a specially designed excitation winding on salient poles below the starting winding, and requiring only a relatively small excitation current. Thus higher efficiencies can be obtained than with the older synchronous induction type, which is only a compromise, seeing that the excitation winding has to serve as a starting winding as well.

The company recently built a 1,200-h.p. motor of this type for a cement mill drive, three-phase, 50 cycles, 3,150 V, at 750 r.p.m. On test its full-load efficiency was 97.6 per cent. at unity p.f., which was obtained by the "segregation of losses" method, all actually measured and included in the calculation. The older "smooth rotor" type would have an efficiency about 1 per cent. less. The difference between the full-load losses of these motors is thus 9 kW, the annual cost of which (at 0.25d. per kWh) is £75.

Road Safety

Sixteen societies took part in a joint meeting organised by the Institution of Automobile Engineers in London on March 1st for the presentation and discussion of papers on the "Essential Road Conditions Governing the Safety of Modern Traffic." Among the papers was one on illumination by Messrs. L. J. Davies and G. S. Lucas, the discussion being opened by Dr. C. C. Paterson.

* Borough electrical engineer, Taunton.

† See Mr. W. B. Parker's explanation of the term "radiant" plate in his letter in this issue.—Eds., ELEC. REV.

Meetings and Discussions

In this issue we refer to four meetings of the Institution of Electrical Engineers. The ordinary meeting held yesterday (Thursday) heard and discussed a paper by Mr. W. J. Jones, of E.L.M.A., who once again stressed the importance of lighting to the industry as a great potential load. Mr. G. F. Shotter opened a discussion on the scope for meters and instruments at the last informal meeting and at the Meter and Instrument Section last week two papers on apparatus for observing and recording surges were presented. Mercury rectifiers were discussed by the South Midland Students on Tuesday. The other item in this section deals with a matter of growing importance—the use of modern steels.

The Lighting Load

AN attempt to estimate the magnitude of the lighting load, its characteristics and its probable trend is essayed in a paper by Mr. W. J. Jones (E.L.M.A.) which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 10th.

It is contended that endeavours to promote the use of electricity for all purposes do not absolve the supply industry from engaging in the systematic development of lighting; and that in many areas the present state is the result of the percolation of national propaganda rather than of positive development forces locally.

The author's statistics indicate that at least 50 per cent. of the total revenue obtained by supply authorities is derived from the sale of electricity for lighting purposes. Further subdivision shows that more than 32 per cent. of the kWh sold under the heading of "lighting, heating and cooking" is used for lighting shops, small factories, offices, schools, &c.

Since not fewer than 350,000 new houses were built in 1937, progress in domestic electrification must be maintained at one million per annum if the bulk of domestic premises is to be on the mains within the next five years. The more remunerative domestic lighting consumers are already connected to the mains. The capital expenditure involved in connecting the remaining potential small consumers is considered by some engineers not to be justified, but the author does not agree, because in several areas the average demand per domestic consumer (of the assisted wiring class) for lighting purposes approximates to 200 W and it is conceded that the average consumption for domestic lighting is at least 200 kWh per annum.

This means that the hours of use per kW of demand must be of the order of 1,000 per annum, and that the annual load factor approximates to 12.5 per cent. The upward trend in illumination level is accompanied by an improvement in load factor. Better artificial light tends to be switched off later in the mornings and on earlier in the afternoons, since it is then superior to daylight, so lengthening the hours of use. Two-part tariffs encourage a freer use of light and there has been a steady increase in the average wattage of lamps sold in this country.

In Shops and Stores

Shop lighting has grown phenomenally during recent years. Increases of 16 to 20 per cent. per annum are not uncommon for whole shopping districts in suburban areas. The wattage per frontage has increased by 150 per cent. in nine years, but progress with interior illumination has been much less.

A typical sample of 24 stores which received reductions in price per kWh amounting to 20 per cent. improved the load factor of the group by 10 per cent. The author is led to the view that many of these stores are paying amply for the electricity they consume, bearing in mind the long-hour use of the load. In some ways large stores set the pace, but small shops can well do with advice from the electrical industry; many interiors are still provided with less than 1 W per sq. ft.

Contrary to common belief, says the author, there is considerable diversity in some types of lighting load and certain forms occur at off-peak periods. In some shop lighting the introduction of a two-part tariff with the fixed charge based on the installed load has resulted in increased consumption, but Mr. Jones's general experience leads him to the view that a tariff with a kVA basis for the fixed charge handicaps progress. He does not favour a uniform type of tariff for all classes of lighting consumers; appropriate modifications should be offered for special requirements.

Now that the new Factory Act, which comes into operation in July this year, gives mandatory powers to the Home Office to require prescribed standards of lighting, there is a likelihood of more rapid improvement in industrial illumination.

During the past three years 1,500 miles of streets have been converted from gas to electric lighting and a similar mileage of new street lighting (where none existed previously) has been provided. But some 500,000 street gas lamps are still in use. The author's estimates of the potential consumptions per annum for various classes of lighting are shown in the accompanying table.

	Present consumption.	Objective consumption.
	Million kWh.	Million kWh.
Domestic	1,400	5,500
Commercial	1,750	6,800
Industrial...	800	3,200
Street lighting	271	1,100
	4,221	16,600

He believes that the stimulation of the lighting load represents an important means of obtaining more revenue per £ of capital expenditure, and concludes his paper with a brief outline of lighting promotion activities in the United States and Canada.

Electrical Measurement

AT the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on February 28th, a discussion on the widening scope of electricity meters and instruments was opened by Mr. G. F. Shotter. There was a large attendance and some remarkable applications of the principles of electrical measurement in industry were described. Mr. Shotter provided an excellent display of instruments and component parts, which were set out in historical order. Subsequent speakers endorsed the opinion that a simple and reliable instrument for metering the elusive kVA should be adopted and it was suggested that considerable benefit would be derived from adopting the Continental practice of marking the scale of the instruments with coded symbols to indicate the type, grade and the method of mounting. Temperature compensation was not imperative in England, except with polyphase instruments, which were often placed in extraordinary situations. The future would produce enhanced opportunities for meter and instrument makers and for the increased staff that would be required to implement the recent meter regulations.

Surge Recorders

TWO papers were presented at the March 4th meeting in London of the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS.

One of them, by Capt. D. I. McGillewie, R.N., describes portable cathode-ray apparatus for the visual examination and/or photographic (external) recording of high-speed transient phenomena, either controlled or otherwise.

The outfit is arranged for operation from 50-cycle, a.c. mains, the glass bulb being of the high-vacuum type for 5,000 V maximum, though the mains unit is designed for 6,000 V. The instrument is constructed in two parts, each in a separate box, which are connected back to back by plugs and sockets. It is said to be extremely simple to operate.

The beam is normally shut off by means of a negative voltage on the modulating grid. A 3-electrode spark-gap is so arranged that when broken down by an incoming transient, or artificially applied impulse, it brings the cathode-ray spot to full brilliance almost instantaneously for a controllable length of time, and, at the same time, sweeps it across the screen at a speed which can be varied from 1 or 2 microseconds to 1 millisecond for a single horizontal sweep. A simple oscillatory circuit operated by the spark-gap is arranged to provide a time-marking wave when desired.

The screen diameter is 5.5 in. and the camera is fitted with an f/1.9 Dallmeyer lens, photographic records being on 6 by 4.5 cm. sensitised paper coated with Ilford Type-F emulsion. The recording speed is very high, but should be higher still when vacuum tubes become available for operation at higher voltages. The life of the cathode-ray tube is not appreciably shortened by leaving the apparatus ready for operation for long periods, as the beam remains shut off except when the equipment is actually recording. This feature renders it especially suitable for the investigation of the effects of lightning surges on power transmission lines.

The apparatus was developed in the North Woolwich laboratories of Standard Telephones & Cables, Ltd., whose Type-4063-AB tube is utilised.

The second paper, by Mr. K. J. R. Wilkinson (British Thomson-Houston Co., Ltd.) describes means of producing and viewing recurrent surges suitable for use in analysing the transient behaviour of power engineering circuits.

He also uses a high-vacuum glass bulb cathode-ray oscillograph, with an especially fast time base, as an indicator; the generator is a mercury vapour grid-controlled discharge tube (or thyratron valve). For working at speeds greater than one mm. per microsecond in the time direction, yet without sacrificing either brilliancy or positional stability of the image, the author has devised a circuit for operating this combination at an image-recurrence frequency of about 1,000 cycles per second. Thus a time-scale velocity of 30 mm. per microsecond can be used with adequate brilliancy under standard conditions of cathode-ray tube voltage and beam current.

Such a combined instrument can be applied to the examination of transformer and alternator surge behaviour, the measurement of surge impedance and transit time in cables, and the efficacy of voltage linear surge protective circuits. It can be adapted also to the measurement of rectifier and thyratron behaviour at times of current-making or -breaking. With the high-speed recurrent-surge oscillograph improved means now become available for the measurement of "initial" voltage distribution in transformer windings, *i.e.*, the coil-voltage distribution which is set by capacitance values, consequent upon the application of unit function voltage to the stack.

By this means also phenomena which accompany the interruption of current and switch action can be examined with considerable facility.

Modern Steels

SPECIAL steels and their applications to engineering and shipbuilding are treated of in a paper by Dr. T. Swinden (director of research, United Steel Co., Ltd.), which was read before the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS at Newcastle-on-Tyne recently.

So far as the author is aware there do not appear to be any outstanding metallurgical problems that should retard the welding of mild steel of normal composition. Certain problems still require solution in relation to the welding of high tensile or low alloy structural steels. But if not required to exceed a tensile strength of, say, 35 tons, it is possible to obtain reliable steels with a small carbon content which can be welded with reasonable satisfaction. Steel of a tensile strength of 37-43 tons tends to produce a hardened zone behind the weld, which is often accompanied by cracking; titanium has been used as a typical inhibitor.

Basic information concerning the special characteristics of the higher-alloyed steels is contained in an appendix to the paper. Criticism of lack of uniformity in surface hardening should be allayed by a quality of electric steel now produced. The "Tocco" process of surface hardening has "tremendous appeal from the scientific point of view." It relies on the use of a high-frequency current for heating the surface of the part to be hardened, followed by rapid quenching by water supplied through holes in the inductor coils. The process is being used regularly and the controlled precision with which it can be carried out is very attractive.

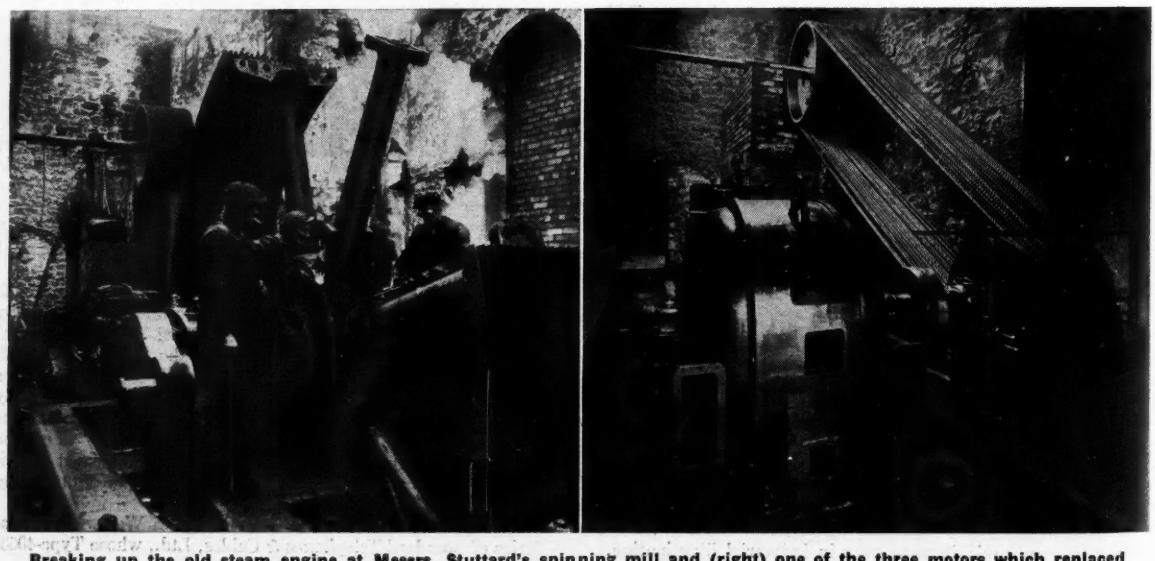
Concerning steels for use at high temperatures, new work by the author indicates that treatment with aluminium definitely reduces "creep" resistance, and silicon increases creep resistance in a very important manner.

The paper contains data relative to material that can be advised with complete confidence (says the author) for making turbine through-bolts, valve-cover bolts, steam pipe-range flange bolts, and superheater tubes, &c. Dr. Swinden states quite definitely that the higher-chromium steel is inferior in several respects to steel containing about 1 per cent. chromium, within the ranges of temperature likely to interest the power-house engineer.

Mercury Rectifiers.—Hitherto the activities of the South Midland Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS have been limited to Birmingham and Rugby. The first students' meeting to be held in the East Midlands area took place at Loughborough on March 8th, when a paper by Mr. J. E. Woollaston was presented. The author's aim was to explain the mode of operation and control of mercury arc convertors. He pointed out the peculiarities of rectifier transformers and said that some of the most effective and economic forms of connection incorporated inter-phase transformers. Reactance at the source of supply and in the input transformer caused overlapping between consecutively phased anodes and so contributed to the negative regulation of convertors. Grid control enabled them to be used for other purposes than rectification.

Electrifying a Cotton Mill

IN the cotton mill of Messrs. James Stuttard & Sons, Ltd., at Sabden, near Burnley, the Lancashire Electric Power Co. has recently installed electric motors totalling over 1,000 h.p. to replace a steam engine in the circumstances referred to in our leading columns. The layout of the existing shafting lent itself to the use of three motors to take care of the principal departments with smaller motors elsewhere. A rope drive has been retained for the three main units; individual drive was not practicable and in any event was out of the question in view of the urgency of getting the mill running again. Raw cotton is delivered to the mill by means of a 5-h.p. motor on a self-landing hoist. A 20-h.p. motor drives the machinery comprising a hopper bale opener, blower and dust-extracting fans, thread extractor and roving waste opener, while a 10-h.p. motor takes care of the stripping machine which delivers the strippings from the card room. The cotton is then automatically fed down to the blowing room—which in turn is driven by a 75-h.p. motor—where it passes through two sets of machinery comprising hopper feeders, Buckley openers and single process machinery to four finisher scutchers. A motor of 375 h.p. takes care of the card room machinery which comprises carding engines, drawing, slubbing, intermediate and roving frames. To drive the ring spinning room, a 550-h.p. motor has been installed in what was the old engine house, and the material saving of floor space due to the displacement of the engine will now be utilised for a needed enlargement of the spinning room itself. Twist and weft are spun on some 30,000 ring spindles and a portion of these are on high draft ring frames. This section also embodies a further 4,000 doubling spindles. The mechanics' shop machinery is driven by a 7½-h.p. motor. The main low-voltage switchgear and motors are of B.T.H. manufacture.



Breaking up the old steam engine at Messrs. Stuttard's spinning mill and (right) one of the three motors which replaced it—a 550-h.p. machine

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Boiling-plate Characteristics

In his interesting comments on my recent article Monsieur R. Sevin expresses the view that my tests were insufficiently comprehensive to form the basis of any conclusions, but the chief conclusion I reached—that the plate of the future would be of a type less affected by the utensil than is the solid plate—is rather supported by your correspondent's statement that in France "the radiant plate is coming more and more into use."

M. Sevin's explanation of the small loss of efficiency when the reflector of a tubular sheathed plate is dirty seems undoubtedly a valid one. Under these conditions the temperature of the reflector would rise rapidly, and the black surface would then radiate heat effectively in an upward direction. Thus a dirty "reflector" would act more by re-radiation than by reflection.

However, I am convinced that my explanation of a considerable heat-transfer by conduction applies to the particular plate which I tested. This is shown by the fact that, even after a long period on full heat with a flat-base utensil, the greater portion of the tubular-sheathed element does not attain a visible red heat. Actually, with the plate in question the loss of efficiency with a dirty reflector is even smaller using flat-base pans than with the cheap enamel types which have concave bases of high radiation absorption factor.

I think there is a certain amount of confusion as to what constitutes a "radiant" plate. Throughout my article I used this term to apply only to the exposed-resistor types as I prefer the term "semi-radiant" for all those plates which transfer heat effectively to the utensil by both radiation and conduction, including the tubular-sheathed type which is often termed radiant. Thus in the editorial note in your issue of February 25th, where you refer to the adoption of "radiant" plates at Stoke Newington, while I favoured the "semi-radiant" type, the plates in question are probably of the tubular sheathed type which would be included in my designation.

W. B. PARKER.

Monkseaton, Northumberland, *March 5th.*

Applying for an Appointment

While I would not be so bold as to suggest that most appointments are filled by influence as your correspondent "Cos ϕ" maintains, I do feel that the process of the young engineer getting on in the world is unduly restricted by the attitude of employers, in particular municipal supply undertakings.

From my experience it seems that unless one is at the time in an appointment precisely similar to the vacant position, one does not stand the remotest chance of securing it. The report that Mr. "A." of "X." undertaking has secured an appointment with "Y." undertaking, and that his place is being taken by Mr. "B." of "Z." undertaking occurs with monotonous regularity.

Whilst I am the first to appreciate that specialisation has come to stay I feel that employers should carefully study the experience of candidates and not place too much weight on their present positions, as I am certain that a wide experience will always be found useful in any appointment, backed up, of course, by a good knowledge of the particular work to be carried out.

AMBITIOUS.

March 4th.

The E.D.A. Salesmanship Course

Referring to your editorial comments on this subject in a recent issue, one of the chief reasons for inaugurating the course was to improve the status of both the salesman and the sales engineer. Therefore every salesman in the industry, whether employed in an engineering capacity or not, should be only too pleased to study for, and pass, the examination, which we hope and believe will be adopted as a recognised standard on which to assess the capabilities and knowledge of any individual who uses the title "Salesman."

It is most important for sales engineers to possess the certificate as without applying the fundamental principles which are contained in the six booklets which comprise the course he cannot by any stretch of imagination call himself a salesman.

The salesman of to-day is the sales engineer of the future, and although we agree that engineering knowledge is essential the possession of the salesmanship certificate should double his chances of success when applying for other and more remunerative positions. That is what I, and the rest of the twelve hundred who took the course, fondly imagine and hope will be the case. Although we have all benefited from the knowledge obtained, most of us took it with an idea of improving our own positions in the industry as well as improving our salesmanship.

You are quite right in suggesting that a man in an established position would not be inclined to take the examination, but there are comparatively few men who are so placed and satisfied with their position. It is the younger men with ambition with whom I am chiefly concerned. No sales engineer should be too proud to study for the examination with junior members of his staff. There is nothing degrading in this, and it is far better than knowing that his staff have more qualifications than himself.

E.D.A. is right in tackling the job of improving the status of both the salesman and the sales engineer, and is to be congratulated upon introducing and being responsible for carrying out something which was so obviously needed. It is one of the best things that has ever been done by the Association.

Brighton, *March 5th.* R. H. COX.

Change-overs and Power Factor

Referring to Mr. Cawthra's letter in the February 25th issue of the REVIEW, if the change-over is done by the supply authority it is in the consumer's own interest to see that the new motors are of the same *efficiency* as the old. If the existing d.c. motors are, say, 90 per cent. efficient then the newly installed motors should be the same. As a.c. motor efficiency is dependent upon power factor, then the supply authority should correct this.

It may happen that the existing d.c. motors are only working at part load. If this is the case and the consumer insists that an a.c. motor of corresponding h.p. is installed then, of course, p.f. will be low, in which case it will be the consumer's place to effect an improvement. If, however, all motors are working at, or very near, full load then the consumer must see that the voltage is maintained at the correct level, then power-factor correction should not be necessary.

I cannot agree that a change-over from d.c. to a.c. should make a difference of 50 per cent. in the maximum demand, if the same h.p. is to be installed and the motors are to work at full load. The consumer will not get any reduction in charges due to the grid scheme as Mr. Cawthra suggests they anticipate, as I am sure the supply authority's kW demand charge would be the same for a.c. or d.c. supply.

FRANK BUXTON.

Overstrand, Norfolk, *February 26th.*

Refusal to Connect

I thank Mr. Withers for his "chapter and verse" but would respectfully point out to him that although he has given us the right chapter, he has quoted the wrong verse. Regulation 705 (d) refers only to motors rated over ½ h.p. and the motors under discussion are under that size; therefore his remarks about "unsound practice" and "contravention of the regulations" are wrong.

Furthermore, if isolating switches were provided under each switch-fuse, as he appears to suggest, the danger of a total breakdown would be just as great because a live terminal of one of the isolating switches is as likely to break down as the live terminal of a switch-fuse. The same applies to a distribution board, as if any fault develops in the board there is every possibility of a complete breakdown.

I am still waiting to learn from Mr. Hunter on what authority he based his refusal to connect. W. E. STEWARD.

London, W.C.2, *March 5th.*

Both Mr. Buxton and Mr. Withers are in error regarding the I.E.E. Wiring Regulations, 10th Edition. I would point out to Mr. Buxton that Regulation 201, dealing with the arrangement of final sub-circuits, states: (A) " . . except that where there is only one final sub-circuit it may be directly connected to the main switchgear." (C) "A final sub-circuit having a rated capacity not exceeding 15 amperes may supply any number of points up to 10 . . ." The limit is 15 amperes, not 600 watts as stated by him.

Mr. Withers says that in the event of a fault in any one of the switch-fuses controlling the motors it would be necessary to shut down all ten of them. But how often do switch-fuses break down? Very rarely indeed, especially when used for such light loads, whereas with the motors connected to a two-way fuseboard the blowing of a fuse would put five of

them out of action and this possibility is considerably greater than that of a switch-fuse breaking down.

He also refers to Regulation 705 and gives the impression that the main switch and fuses constitute a starter. This is definitely wrong for Regulation 705 reads thus: "Every electric motor shall be provided with an efficient switch or switches for starting and stopping, so placed as to be easily operated by the person controlling the motor, and every electric motor having a rating exceeding ½ h.p. shall be provided with . . . ." Then follow sub-sections A, B, C and D dealing with starting gear, etc.

As the fan motors in question were rated at less than ½ h.p., in the light of the foregoing Regulations Mr. Gummerson could have fitted a main switch and fuses at the service position and looped the fans, controlling each with an isolating switch. He apparently went one better and fixed switch-fuses in place of the isolating switches. I therefore agree with Mr. Milne that it was unreasonable of the supply authority to refuse to connect the installation. Leonard Chapman.

Surbiton, *March 4th.*

I cannot see why Mr. Gummerson should expect Mr. Hunter to give him a supply, as the individual control gear (*i.e.*, switch and fuses) for each fan cannot be isolated to carry out any necessary repairs to the starting gear without isolating the whole ten fans.

I have had to suffer from similar installations, only with larger motors looped, and I know to my sorrow how bad this practice can be, whatever it sounds like in theory.

March 3rd. Maintenance Engineer.

The real point at issue is whether the Morley Corporation can refuse to couple up the installation in question. The reply is definitely "No"—there is no infringement of Home Office or Electricity Commissioners' Regulations and no court would uphold the Corporation engineer's refusal.

However praiseworthy the I.E.E. Wiring Rules may be they have no legal standing except by agreement.

W. A. Hatch, M.I.E.E.

St. Helens, *March 7th.*

In my opinion it is most unreasonable of Mr. Hunter to expect Mr. Gummerson to make any alteration to a circuit which fully complies with the I.E.E. Regulations, especially as the request is to do with two sets of fuses what can be done so much more effectively with ten sets.

I am unable to find the regulation which Mr. Buxton states limits the rating of a final sub-circuit to 600 W. Mr. Gummerson's arrangement is very much superior to that suggested by Mr. Buxton because each circuit is independent. I would have used ⅝ in. conduit with three cables in each of 1/.044 or 3/.029. Further, I would have had no compunction in fitting tee joints above the switches and pulling six wires through a length of 2 or 3 in. of conduit, although this would not comply with the letter of the law. Actually this is not necessary.

Mr. Withers has forgotten that a faulty lamp in a typical private residence may extinguish all the lights on one floor and that in order to replace the fuse when repaired it would be desirable to open the main switch, so extinguishing the lights on both floors. The switch to isolate the motor switches has been provided by Mr. Gummerson, and in any case sections A, B, C and D of Reg. 705 do not apply to the motors in question as the rating does not exceed ½ h.p.

I consider that the arrangement of wiring by Mr. Gummerson is admirable, and that Mr. Hunter is quite unjustified in his refusal to connect. W. G. White, A.M.I.E.E.

Barnsley, *March 7th.*

In reply to Mr. Milne, before I wrote on this matter to you my firm divided this job to meet Mr. Hunter's requirements, and it was connected up.

As no complaint was made that any rules had been infringed, I am not surprised that Mr. Hunter has not answered Mr. Steward's question. However, Mr. Withers steps in where Mr. Hunter does not tread, and in doing so, perhaps unwittingly, makes Mr. Hunter's position worse.

I did not forget that all motors must be isolated before a fault on any switch could be rectified. If such a fault occurred a new switch could be fixed inside half an hour. It is no more "unsound practice" than having ten lights on a circuit and having to make all dead before repairing one. In fact, it is better, as each fan (which is the likeliest source of trouble) can be inspected and cleaned separately by withdrawing its own fuses.

Next Mr. Withers asserts that the regulations are infringed because it is impossible to isolate any one motor and its starting gear, but if by isolating one you also at the same time with the same action isolate others you commit no infringement. Has he never come across a case of two or three small fans on one circuit? Yet this is the point which he states justifies the refusal to connect. Mr. Withers must now condemn Mr. Hunter's action in connecting up, as it is still not possible to isolate any one motor and switch.

I can assure Mr. Buxton that all conduit, &c., is in accordance with rules. As to sub-circuits, I take it that when a set of fuses is interposed between a main circuit and the consuming apparatus a sub-circuit is formed. Surely on that there is no argument. I contend that up to now no valid reason at all has been given to justify the refusal to connect.

Leeds, 6, *March 5th.* C. J. Gummerson.

Electric Washers

The notes on laundry equipment shown at the B.I.F., published in the Electrical Review of February 25th (p. 274), raise many interesting questions.

Surely the primary reason for installing an electric washer is because it is a real labour-saving and time-saving piece of apparatus. The housewife who has tackled the weekly wash before purchasing a washer is amazed that she has been able to carry on so long without its tremendous help. To my mind the merits of the electrically heated washer, with the hand-operated agitator, compare very unfavourably with the motor-driven agitator.

Domestic science and modern education have convinced the housewife that it is now unnecessary to boil clothes, provided that the water used in the washer is at from 140 deg. to 160 deg. F. Water at this temperature will kill all germs known to this country and keep the clothes a good colour. This high temperature only applies to white linens and cottons.

Another point in favour of this type of washer are the low initial and running costs. The housewife has always been assured of a sufficient supply of domestic hot water to deal with the family wash; therefore the additional manufacturing cost and running cost of the electrically heated washer is unnecessary.

The satisfactory aeration of the water during the process of the washing is highly important. The floating type of agitator seems to me to have great potentialities. It will be understood that the cleanest and soapiest water is at the top of the washer, and because the agitator rests on the clothes its movement of gently forcing the clothes through the water ensures absolutely clean results to the clothes, with a minimum of wear and tear. The saving of time will also be appreciated when no boiling is necessary. White clothes left in the washer for about ten minutes are really washed satisfactorily. The fixed wringer deals with each batch of clothes straight from the washer to the rinsing water. The washer should be so placed that the clothes are passed direct into the kitchen sink. Because the washer and the wringer work simultaneously no waste of time need occur. When the clothes are passed from the washer through the wringer into the rinsing water the next batch should be fed into the washer before the blueing takes place. Working scientifically in this manner about 70 lb. of dry clothes would be washed in one hour. A wash of these dimensions done by hand would necessitate four hours of real hard work.

When the modern housewife is educated to understand how much labour and time and health is saved by installing an electric washer, manufacturers will be assured of a really large market. Mabel G. Reading.

London, W.4, *March 1st.*

London I.E.E. Students' Dinner

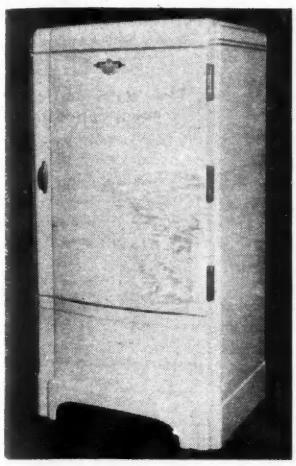
The annual dinner of the London Students' Section of the I.E.E. was held last week at the Florence Restaurant. Always a friendly and informal affair, it was made even more so by the employment of separate tables. Mr. P. H. Pettifor, hon. secretary, proposed the toast of "The I.E.E.," speaking of its kind-hearted and fatherly interest. Sir George Lee (President, I.E.E.), in replying, referred to the tradition of spreading knowledge for the benefit of the generations to come, which was the students' duty. Mr. F. E. Ockenden (Council's representative), also replied to the toast. Mr. A. H. Young (hon. asst. secretary for entertainments) proposed "The Guests" with his usual droll humour, Mr. A. L. Wheeler (deputy chairman, London Students, I.C.E.), responding. The toast of "The Students Section" was proposed by Mr. H. T. Young, who mentioned that the average attendance had increased from 85 to 109, almost a record, during the past year, but that despite its size the Section had only secured 12 premiums whereas the Midlands won 10 and the North Eastern Section 9. Mr. N. C. Rolfe, the chairman, in replying, said that although he was delighted at the successful past year, it was necessary to point out that five out of six of the papers had been produced by past or present committee members. Mr. A. H. Young is to be congratulated on the excellent entertainment provided between the speeches.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Domestic Refrigerators

Two newcomers to the range of domestic refrigerators of FRIGIDAIRE, LTD., Edgware Road, The Hyde, London, N.W.9, are the "Super 8" and "Imperial 13." In general, these two models are designed on the same lines as other "Frigidaire" cabinets.



The Frigidaire "Super 8"

The "Super 8" has a thermometer which is visible from outside the cabinet, and the "Imperial 13" has a food safety indicator built into the second shelf below the freezer. "Freon 114," the refrigerant, is of the low-pressure type and a hermetically sealed ⅛-h.p. rotary compressor is used, overload protection being incorporated. White porcelain enamel is used for both interior and exterior, and "Touchlatch" automatic door openers are fitted.

The shelf area of the two models is 19½ and 29½ sq. ft., respectively, and the ice-making capacity 14 lb. and 19 lb. per freezing. An automatic ice tray release is also provided.

Thermostatic Cooker with Fire

The latest domestic cooker to be introduced by the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1, is the 201J with a thermostatically controlled oven and embodying a reflector fire in the base.

The oven cooking space measures 10⅛ in. high by 11¾ in. wide by 13½ in. deep, sufficient to take 8 lb. of beef, with Yorkshire pudding, baked potatoes, &c. The hinges of both the oven and the hot cupboard are concealed, and the front frame and sides, hinged coverplate, door panels and the removable fret in front of the fire are all vitreous white enamelled. The hob itself has a dull chromium finish, and the interior of both the oven and the hot cupboard are mottled vitreous enamelled. Polished black bakelite is utilised for the door handles and switch knobs, and a black enamelled plinth forms the base of the cooker.

The latest Jackson 201J cooker

The hot cupboard space is 4⅝ in. high, 20¾ in. wide and 13 in. deep, the overall measurements of the cooker being 38¾ in. (height), 22¾ in. (width) and 18 in. Heating of the oven is by side and bottom plug-in elements, with a total loading of 1,800 W. The 8½ in. by 6 in. boiling plate is rated at 1,450 W; although normally of the enclosed type, it can be supplied as a radiant plate at a slight extra cost. A combined 9 in. by 7 in. boiler-griller is loaded at 2,000 W, and below the oven is a two-bar reflector fire rated at 1,500 W. Other points of note are that a 5-A kettle plug and socket is built in and the hob cover-plate forms an attractive table top when closed and an effective splash guard when open.

Contactum Accessories

CONTACTUM, LTD., Cricklewood, have drawn our attention to a mis-statement which occurred in our issue of February 25th. We stated that flush mounting switch-sockets of conventional design are available in 2-A 2-pin, 2-A 3-pin, and 5-A 2-pin, suitable for fitting into standard iron boxes with 2-in. fixing centres. This should read "flush mounting sockets." The 15-A switchplug is made for flush and surface mounting. The pressed steel or teak boxes can be supplied only for the 15-A 3-pin and 5-A 3-pin flush mounting units, whether shutter or open-socket type.

Vacuum Cleaner Developments

The largest of the Hoover range of cleaners (HOOVER, LTD., Perivale, Greenford) has recently been improved.

A faster motor has been fitted, giving also a slightly faster beater speed. The outstanding modification, however, is the connecting equipment for the tools, which can now be slipped into place while the motor is running without the necessity of turning the cleaner upside down and removing the belt. The appearance has been greatly improved, both in design and by the use of a black bakelite motor housing and the easily cleaned grey finish. Adjustment for pile depth has been made automatic by the use of a pair of narrow wheels at the back and wide wheels, which rest on top of the pile, at the front. A foot-operated switch brings the handle automatically into the working position or in a horizontal plane for cleaning under chairs. The weight is 17 lb. 4 oz.—slightly less than hitherto.

The new Hoover cleaner showing the tool rack

The tools have been redesigned and are exceptionally light, being made of duralumin, and a specially designed tool holder enables them to be carried from room to room with ease.

Circuit-breakers for Trolley-buses

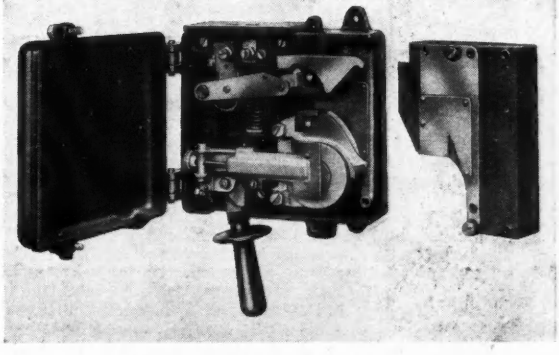
Automatic overload circuit-breakers for protecting trolley-bus equipment should have a maximum rupturing capacity of fully 10,000 A, as against the 3,000 A of the older tramcar types. This is the opinion of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, whose latest fixed-handle type is provided with specially designed arc chutes, blow-out coil and arcing horns. The fixed contact is at the bottom adjacent to the blow-out coil, and the moving contact is of the contactor type, but is operated by means of a bakelite link. The two terminals are screened by bakelite mouldings, and the whole breaker is built up on a heavy bakelite base.

The blow-out system is provided with an iron circuit, which also forms an overload protective system, the breaker being opened on overload by a clapper, which is drawn in by the magnetic flux in the iron circuit and opens the contacts by means of simple trip mechanism. A milled screw enables the trip mechanism to be adjusted over a wide range of overloads, and, by altering the springs, still higher values of settings can be obtained.

Without the overall size of the breaker having been increased, tests at 600 V d.c. (with the breaker frame connected to the supply negative and the currents measured by a surge crest ammeter) indicated a maximum rupturing capacity of 15,000 A.

A Sun-lamp

The "Raysol" is a new general-purpose health lamp of the bowl reflector type incorporating a heater coil element and two therapeutic carbons between which an arc giving visible and ultra-violet rays is struck. It is low in price, and a special feature is a safety time switch whereby the lamp



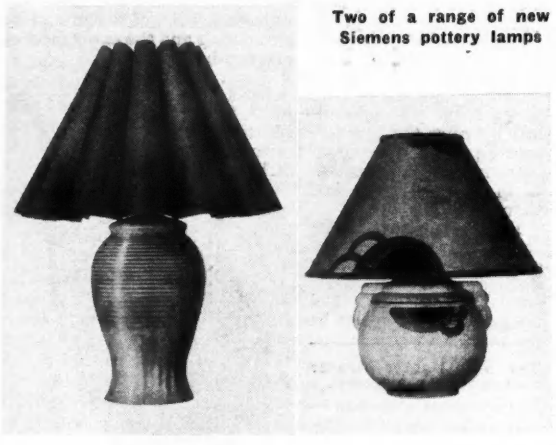
The G.E.C. trolley-bus circuit-breaker

switches off automatically after ten minutes. It is supplied by RAYSOL, LTD., 65, Basinghall Street, London, E.C.2, for direct connection to a.c. or d.c. mains.

Press-button Tuning

The first commercial radio receiver to be controlled and tuned by press button has been brought out by E. K. COLE, LTD., Southend-on-Sea. Although the set can be tuned manually in the ordinary way, as many as eleven stations can be selected automatically by means of press buttons. The drive is by a small electric motor, automatic frequency control pulling the set into exact electrical tune of its own accord.

Having chosen which stations shall comprise the eleven available, the user can easily make the necessary adjustments.

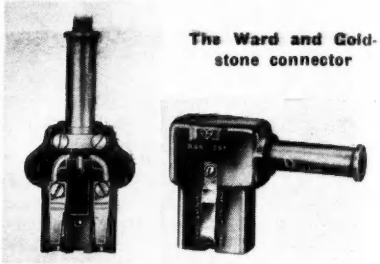


Two of a range of new Siemens pottery lamps

A Reversible Plug Connector

A new reversible plug connector for electric irons has been brought out by WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester, 6. The connector is made to comply with the requirements of B.B.S. 562, and bears the authorised trade mark of the B.S.I. The special features are the dimensional accuracy, quality of material, rigidity of test and the independent method of strain relief for the flexible conductor entering the connector.

The connectors are made in the top entry and side entry types and are supplied in black, walnut, brown or any desired shade. An earthing strip is fitted to each side.



The Ward and Goldstone connector

High-speed Diesel Engines

AS a result of experience obtained in 50,000 miles running of a Diesel-electric rail-car on the L.M.S. Railway, the ENGLISH ELECTRIC CO., LTD., Stafford, has produced a 220-b.h.p., 1,500-r.p.m. six-cylinder (6 in. bore by 8 in. stroke) engine known as the "H" type.

In this the electric generator is integral with the engine to allow of three-pedestal mountings on rubber pads, so that the crankshaft is insulated from coach-frame distortion and engine vibration. A lubricated vibration damper is fitted at the end of the heat-treated alloy steel crankshaft remote from the generator and all auxiliary drives are taken from the flywheel end. The case-hardened steel camshaft (with integral cams running in an oil bath) is driven by a triple-strand chain.

Spring loading of the push rods permits the use of lightly-stressed valve springs. Aluminium-alloy pistons are fitted to drop-forged steel connecting rods with separate steel shells in the big end lined with white metal. Each cylinder cover carries two inlet and two exhaust valves, a centrally placed injector and a safety valve. The fuel pump and governor unit is driven by a side shaft geared to the camshaft by helical gears, the drive to the fuel pump passing through the emergency governor. Pistons, connecting rods and crankshaft-journal bearing caps and shells can easily be withdrawn.

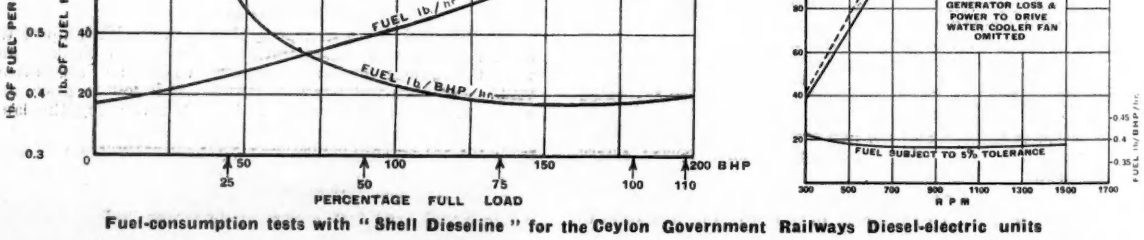
Uniform temperature of the cylinder liners is secured by delivering the cooling water by an engine-driven centrifugal pump to points high up on the crank-case water jackets, from which it flows round the injector body sleeve. Combustion air passes through oil-wetted cleaners and silencers into the induction manifold.

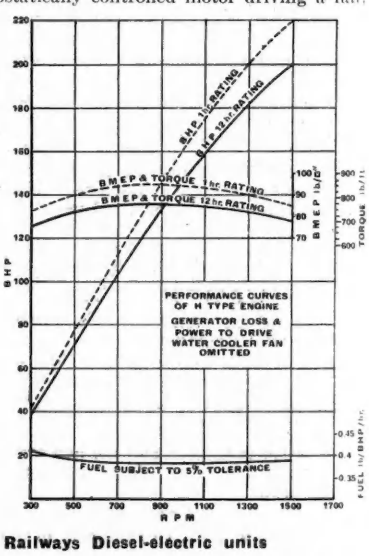
The cast-steel bed-plate forms the lubricating oil reservoir in which is immersed a chain-driven pump which delivers oil at 40 lb. per sq. in. to an "Autoklean" strainer mounted on the bedplate, passing a high-pressure relief valve and *via* a radiator type cooler. Strained oil is conveyed to the crankshaft journals by holes drilled in a cored channel in the side of the bedplate at the end of which remote from the oil feed is a relief valve set for 20 lb. per sq. in. Oil tapped from this channel is taken through a reducing valve to lubricate the overhead valve gear and camshaft at 5 lb. per sq. in.

By varying the angular position of the control lever of a C.A.V.-Bosch governor three speed-ranges are obtainable. Solenoid-operated valves admit exhaust oil taken from the lubricating system to or from three pistons, each of which bears on a crank attached to a lever that transmits its motion through coupling links to the governor lever and to the injection timing control. When a solenoid is energised, its piston pushes the crank through the angle necessary to set the governor to the required speed position, which may be varied by adjusting a stop pin. The crank is held against the pistons by a return spring housed in the tube connected to the crank lever on the side opposite the fuel pump.

This spring shuts down the engine on the functioning of any of the safety devices (except the emergency governor, which acts directly on the fuel supply), by breaking the solenoid circuits. Safety devices include those for guarding against low lubricating-oil pressure and low water level. The equipment also includes a lock-up altitude device which controls the maximum possible fuel charge per cycle and also prevents overloading due to loss of power from any cylinder.

The combined lubricating oil and circulating water cooler is fitted with a thermostatically controlled motor driving a fan, which is started up when the water temperature exceeds 180 deg. F. or the oil temperature exceeds 140 deg., and is shut down when the temperatures fall to 10 deg. below these values.





Fuel-consumption tests with "Shell Dieseline" for the Ceylon Government Railways Diesel-electric units

Six engines of this type were fitted in the Diesel-electric trains recently supplied to the Ceylon Government Railways and described in the ELECTRICAL REVIEW of January 28th, when reference was made to the methods of starting and controlling the speed. In these units only 180 b.h.p. at 1,350 r.p.m. was catered for. The results of the official acceptance tests are now available and are summarised in the accompanying curves. The tests comprised a continuous run of 8 hr. at full load (180 b.h.p.), 1 hr. at 5 per cent. overload, ¼ hour at 10 per cent. overload, 1 hr. at ¾ load, and 1 hr. at ½ load. Deductions from the powers shown were made for temperature of 2 per cent. per 10 deg. F. over 90 deg., and for altitude of 4 per cent. per 1,000 ft. over 500 ft. above sea level. Lubricating oil consumption averaged over the 11¼ hr. run 0.45 pints per hr. which is equivalent to 0.00285 lb. per b.h.p.-hr.

German Electrical Exports

Further expansion last year

GERMAN exports of electrical machinery and apparatus made further progress last year. Their total value was 312,290,000 Rm. and weight 1,570,810 double centner, the corresponding figures for 1936 having been 258,314,000 Rm. and 1,317,500 double centner. Electrical imports totalled 19,133,000 Rm., a small advance.

The following statement, based on the recently issued official returns, shows the value in thousands of marks, weight in double centner, and, in some instances, the number of pieces of electrical material exported, with the values and principal countries of destination of the more important groups of articles. Outstanding destinations for the dynamo, motor, &c., group were: Up to 5 double centner, Sweden, Brazil, Belgium, Argentina and Finland; heavier units, Argentina, Brazil, India, Soviet Union, Yugoslavia, Sweden and Finland.

	1937.	Inc. or dec. on 1936.
Lighting and starting apparatus for motor vehicles—		
Value Rm. (1,000)	3,443	+ 518
Number	87,667	+ 19,322
Weight (double centner) ...	9,656	+ 2,276
Dynamos, motors, convertors and transformers, up to 5 double centner—		
Value...	21,020	+ 3,056
Number	1,291,563	− 59,063
Weight	93,446	+ 16,766
Dynamos, motors, convertors and transformers, from 5 to 30 double centner—		
Value...	6,930	+ 1,300
Number	4,541	+ 875
Weight	48,946	+ 10,096
Dynamos, motors, convertors and transformers, over 30 double centner—		
Value...	10,100	+ 3,140
Number	734	+ 117
Weight	89,910	+ 23,080
Armatures and commutators—		
Value...	3,273	+ 393
Weight	13,983	+ 2,643
Cable—		
Value...	22,304	+ 6,016
Weight	388,201	+ 32,148
To Holland	2,540	+ 290
„ Sweden	2,240	+ 960
„ Argentina	2,100	+ 550
„ South Africa	1,230	+ 210
„ Greece	1,410	+ 760
„ Rumania	1,770	+ 140
Accumulators, plates, etc.—		
Value...	3,603	+ 433
Weight	40,162	+ 4,322
To Holland	970	− 20
„ Finland	135	− 15
„ Argentina	340	+ 100
„ Brazil	120	+ 45
„ Sweden	207	+ 27
„ India	240	+ 90
Electric irons—		
Value...	1,077	+ 277
Heating and cooking apparatus—		
Value...	9,190	+ 2,400
Galvanic batteries and parts and heating elements—		
Value...	3,600	+ 1,290
Weight	31,270	+ 9,680

	1937.	Inc. or dec. on 1936.
Measuring and recording instruments—		
Value...	22,150	+ 920
Weight	19,270	+ 2,000
To Soviet Union	1,310	− 1,840
„ Belgium	1,090	+ 375
„ Holland	1,450	− 180
„ Great Britain ...	1,545	+ 135
„ Sweden	1,890	+ 210
„ Argentina	1,130	+ 380
„ Italy	1,120	− 150
„ China	640	− 10
„ Czechoslovakia ...	890	+ 210
Metal filament lamps—		
Value...	10,750	+ 1,710
Thousands	51,816	+ 8,026
To France...	720	− 195
„ Denmark	960	− 30
„ Sweden	690	+ 180
„ Italy	750	+ 100
„ Chile	580	+ 240
„ Argentina	350	+ 70
Telephone material—		
Value...	16,830	+ 2,440
Weight	12,740	+ 2,070
To Jugoslavia	1,080	+ 750
„ Italy	1,822	+ 62
„ Holland	3,400	+ 630
„ Greece	1,734	+ 454
„ China	1,290	+ 290
Radio material—		
Value...	33,590	+ 5,645
Weight	41,890	+ 3,605
To Finland	1,140	+ 40
„ France...	2,110	− 290
„ Italy	1,160	− 360
„ Holland	2,900	− 550
„ Sweden	2,550	− 100
„ Switzerland	1,130	− 150
„ Czechoslovakia ...	1,130	—
„ Brazil	1,180	+ 490
„ Bulgaria	1,950	+ 1,390
„ Denmark	1,390	+ 350
Safety and signalling apparatus—		
Value...	3,960	− 1,210
Weight	6,930	− 970
To Great Britain ...	830	+ 380
„ Argentina	290	+ 150
„ Holland	440	+ 30

	1937.	Inc. or dec. on 1936.
Ignition apparatus, etc., and parts (excl. magnetos) and elec. accessories for motor vehicles—		
Value...	15,450	+ 4,380
Weight	20,410	+ 5,720
To France...	1,200	− 250
„ Italy	1,440	+ 720
„ Sweden	1,530	+ 600
„ Great Britain ...	1,780	+ 390
„ Czechoslovakia ...	1,310	+ 470
Apparatus for lighting, power transmission, electrolysis, resistances, etc.—		
Value...	70,496	+ 11,046
Weight	235,200	+ 42,930
To Belgium	3,510	+ 660
„ India	2,200	+ 850
„ France...	3,125	− 345
„ Italy	2,380	− 660
„ Holland	7,900	+ 1,950
„ Sweden	8,820	+ 650
„ Argentina	2,650	+ 900
„ Great Britain ...	3,080	+ 390
„ Finland	3,130	+ 1,010
Telegraph or telephone insulators—		
Value...	2,510	+ 800
Weight	38,280	+ 12,660
Electro-medical and dental apparatus—		
Value...	14,250	+ 1,620
Carbon and brushes, microcarbons, etc.—		
Value...	1,800	+ 145
Weight	977	+ 107
Arc lamp carbons—		
Value...	1,700	+ 130
Weight	4,355	+ 205
Electrodes—		
Value...	8,250	+ 1,740
Weight	233,700	+ 59,480
Conduit tubes of paper or cardboard—		
Value...	1,745	+ 530
Weight	38,000	+ 9,300

Flame Proof and Mining Plant

THE customary quarterly list of electrical apparatus for which certificates of flameproof enclosure ((1) methane, (2) petroleum and acetone vapours, (3) coke oven and coal gases) were granted by the Mines Department during the quarter to December 31st, 1937, includes the following:—

Belmos Co. (1) 660-V resistance units up to 6.72 kW.

Beckett & Anderson, Ltd. (1) 650-V, three-phase, s.c. motor, 6-8 h.p., with air-break reversing switch.

British Thomson-Houston Co., Ltd. (2) 650-V, three-phase motors, s.c., 5-17.5 h.p.; (1 and 2) three-phase, 660-V and 3,300-V oil-immersed circuit-breakers; (1) air-break direct-on reversing starter; (2) single-phase 250-V petrol pump motor with internal switch and worn-wheel shaft.

C. Crofton & Co. (Engineers), Ltd. (1) 660-V "Victor" 100-A bolted plug and socket with pilot contacts for interlocking.

Electrical Apparatus Co., Ltd. (2) Three-phase 650-V motor control panels, 60-A manual and automatic star-delta types.

Electrical Power Engineering Co. (B'ham), Ltd. D.c. motors for acetone vapours.

George Ellison, Ltd. (1 and 2) Three-phase 650-V oil-immersed circuit-breakers up to 100 A, start-delta starters and change-over switch.

E. M. B. Co., Ltd. (1) 660-V resistance units up to 6.72 kW.

Wilfrid Francis & Co., Ltd. (2) Multi-push-button boxes, 2 A at 220 V and 1 A at 550 V; (1) 100-A resistance units up to 650 V.

General Electric Co., Ltd. (1) Three-phase air-break isolating switch for 200 A at 6,600 V and three-phase oil-immersed circuit-breaker for 200 A at 440 V; (1 and 2) air-break d.p. switch and fuse for 60 A at 500 V and single-phase lighting transformers of 3 kVA at 3,300 to 110 V with d.p. isolator and fuses and outgoing switch-fuse; (2) multi-conduit junction boxes and 220-V three-lamp indicator box.

Horace Green & Co., Ltd. (1) Three-phase s.c. motors of 2-4 h.p. at 100/600 V and slip-ring unit for 140 A at 500 V.

Greenwood & Batley, Ltd. (1) Special d.c. motor of 2 h.p. at 500 V for association with gate-end loader.

Heyes & Co., Ltd. (1 and 2) Air-break switch-fuses for 30 A at 660 V, triple- and double-pole; (1 and 2) 150-900-300 W well-glass lighting fittings; single-phase 500-230-15-V signalling transformer.

J. H. Holmes & Co., Ltd. (1 and 2) Three-phase s.c. motors, 1 to 5 h.p. at 650 V for 25 and 35 to 60 cycles.

Klaxon, Ltd. (2) Warning signal for 6 to 250 V d.c., or single-phase a.c.

Laurence, Scott & Electromotors, Ltd. (1 and 2) 110 to 650 V d.c. motors of 2.5 to 6.7 h.p., d.c. generators of 1.8 to 4.8 kW and three-phase s.c. motors of 0.5 to 1 h.p.

M. & C. Switchgear, Ltd. (1 and 2) Air-break straight-on starters of 2 to 7.5 h.p. at 220-260 V.

Mather & Platt, Ltd. (1 and 2) Frame-ventilated three-phase motors up to 750 h.p. at 6,600 V, slip-ring and squirrel case.

Mavor and Coulson, Ltd. (1) S.c. conveyor motors combined with starter and brake solenoid of 10 to 20 h.p. at 500 V.

Metropolitan-Vickers Electrical Co., Ltd. (1) S.c. conveyor motor; (2) transformer tanks, dry air-cooled and oil-immersed, not exceeding 5 kVA at 3,300 V single-phase, or 2 kVA at 3,000 V and 3 kVA at 650 V three-phase; (1 and 2) small slip-ring units of 150 and 400 A at 650 V three-phase with short-circuiting gear and labyrinth shaft gland for association with motors having sleeve bearings; (2) squirrel-cage motors.

Mining Engineering Co., Ltd. (1 and 2) S.c. motors and (1) thermal overload tripping unit.

Morley Electrical Engineering Co., Ltd. (1) Reversing d.c. push-button box for 2 A at 600 V; d.c. motors and starters for gate-end loaders of 3 to 5 h.p. at 230-600 V.

W. & H. Nelson, Ltd. (1) Cable junction box for 200 A at 660 V; air-break drum controller of 50 h.p. at 500 V; air-break circuit-breaker of 20 to 100 A up to 600 V three-phase.

Siemens Bros. & Co., Ltd. (1 and 2) Magneto telephone.

Siemens-Schuckert (Gt. Britain), Ltd. (1) Three-phase air-break contactor unit of 15 A at 125 V, 25-50 cycles, for remote control of drilling machine.

Siskol Machines, Ltd. (1) Motors.

Solenoid Regulator Co. (2) Single-, two- and three-phase air-break starters for 500-V, 20-A star-delta and 15-A push-button direct-on.

Sullivan Machinery Co. (1) Three-phase s.c. coal-cutter motor and starter of 60 h.p. at 650 V.

Walsall Conduits, Ltd. (2) Air-break t.p. switch and fuse of 5-15 A at 500 V.

Allen West & Co., Ltd. (1 and 2) Single and double push-button switches up to 6 A at 250 V, or 2 A at 660 V.

Parliamentary News (BY OUR SPECIAL REPORTER)

Central Sussex Electricity Bill

A Select Committee of the House of Lords began consideration on March 2nd of the Bill promoted by the Electricity Supply Corporation, Ltd., providing for the transfer to the Corporation of the undertakings of Burgess Hill Electricity, Ltd., Central Sussex Electricity, Ltd., Seaford and Newhaven Electricity, Ltd., and Steyning Electricity, Ltd., and also the electricity undertaking of Uckfield Gas and Electricity Co. Lord Cautley presided. Petitions against the Bill had been lodged by Brighton Corporation, Worthing Corporation, Chanctonbury R.D.C. and the Ringmer and District Electricity Co., Ltd.

Mr. Craig Henderson, K.C., for the promoters, said that they already owned nearly all the shares in the companies concerned and it was now proposed to dissolve the subsidiary companies, transfer them to the Corporation, which was now a holding company, and put all the undertakings under one ownership. By unified management, economies had been secured, and it was anticipated that the provisions of this Bill would lead to further economies. One object of the promoters was to free the Corporation from the criticism and suspicion which to-day was directed to holding companies.

The chairman pointed out that the Corporation was operating undertakings in Scotland and Falmouth and asked whether if this Bill passed they would become one with the Sussex undertakings and all the profits would be pooled.

Mr. Craig Henderson said that this would not necessarily be the case. Each undertaking would be run separately and the Corporation must keep separate accounts. The companies would have one central staff, the cost of which would be allocated. The Ministry of Transport considered that in view of the intention of the Government to introduce a general public Bill amending the law with respect to the supply of electricity there should be inserted in the present Bill a clause providing that nothing in the Bill should prejudice any application for a general public Bill introduced in this or the next session of Parliament; this had been done.

Mr. A. J. Fippard, chairman of the Corporation, said that the average return from the Burgess Hill undertaking was 4.4 per cent. over three years, from Central Sussex 2.3 per cent. over 10 years, from Seaford and Newhaven 5.3 per cent., from Steyning 3 per cent., and from Uckfield 1.8 per cent. Units sold (excluding Seaford and Newhaven) increased from 12 million in 1935 to 19 million in 1937. The Corporation had introduced a domestic two-part tariff with a unit charge of ½d. Whereas the revenue from consumers on the flat-rate charge increased in the last three years from £25,950 to £26,450, the revenue from those on the two-part tariff increased from £24,982 to £46,433.

It was the practice of the Corporation in regard to capital extensions to buy material and carry out the extensions through their contracting department, charging the constituent company for whom the work was done 2½ per cent. on the cost with an over-riding addition of 7½ per cent. The amount of profit to the Corporation, however, was very small. In 1936 it only amounted to just over £2,000, although there was an expenditure of £70,000 on capital account.

Mr. Fippard agreed with Mr. S. Turner, K.C., for the Ringmer and District Electricity Co., that the Bill did for the five companies what might be done after a local inquiry when general consideration was given to the matter under the Government Bill. Asked what the object of the Bill was if it was not merely tactical, Mr. Fippard said that the objects were to secure economies so that they would not have to increase prices which with rising costs might be necessary, and to get rid of the suspicion which attached to holding companies. He knew of no other object.

At a later session Mr. Fippard, cross-examined by Mr. J. H. Thorpe, K.C., on behalf of Worthing Corporation, said it was true that the Burgess Hill Co. paid in 1933 a dividend of 10 per cent. and that in 1934, having been taken over by the Corporation in January, 1934, the dividend was 4¼ per cent. Burgess Hill was a d.c. company, and the change-over of the plant to a.c. and the alteration of consumers' apparatus must have an effect on profits.

Replying to a question as to whether the anticipated savings under this Bill would be passed on to the consumer, Mr. Fippard said they anticipated that savings would make it unnecessary to increase prices even if costs increased. He knew no comparable area with electricity prices so low as they were in central Sussex, but as soon as they got a fair return on capital they would consider reduction of prices. They did not now pool their resources so as to make good losses in Falmouth or Peterhead out of Steyning or Seaford revenue, and they would undertake not to do it in future. He did not think that any of the individual companies would be made undertakers under the McGowan proposals, but if the area could be worked as efficiently by the Electricity Supply Corporation as by anybody else he thought there was a possibility that the Corporation would be made undertakers for the area.

Asked why the Corporation had selected this time, knowing reorganisation was to take place, to ask for the amalgamation of the separate undertakings, Mr. Fippard said that he thought it would be in the best interests of the Corporation. He again denied that they were endeavouring to secure a tactical advantage.

The Committee conferred in private, and the chairman announced that it had decided that the Bill should not be allowed to proceed. The Bill was, therefore, rejected.

[The Central Sussex and the Uckfield Companies have extensive areas adjoining one another. The Burgess Hill Company has supply powers in an "island" in the middle of the Central Sussex area. The Steyning Company's district abuts on both the Brighton and Worthing Corporations' territory, while that of the Seaford Company adjoins the Brighton area.—EDS. ELEC. REV.]

Air Raids and Utility Undertakings

On March 9th Sir J. Mellor asked the Home Secretary whether he had yet come to any decision as to the principles which were to govern the nature and amount of grants to public utility undertakings in regard to air-raid precautions.

Mr. G. Lloyd said that inquiries into the most effective way of assisting essential public utility undertakings to continue functioning in war time, including consultation with the authorities concerned, were in progress in the case of electricity, gas and railways, and were about to begin in the case of water supply and dock and harbour authorities. As soon as the inquiries were completed it would be possible to indicate the amount of grant and the principles of its distribution.

London Passenger Transport Schemes

On March 9th Sir R. Glyn moved the second reading of the London Passenger Transport Board Bill, and enumerated many of the improvements which the Board hopes to effect in London traffic. Of most vital importance in connection with all services of defence contained in the Bill, he said, was that of the interchange of electrical supply. In time of emergency it was necessary to maintain underground communications. Up to now it had been possible for the Board to rely solely on its own sources of supply. In the Bill the Board sought power, with the Central Electricity Board, to make such agreements as were now considered essential.

Mr. Parker moved the rejection of the Bill, and pleaded for a "square deal" for the Eastern area. The rejection was supported by Mr. Keeling and other members on the ground that further powers should not be granted to a corporation holding a statutory monopoly which, by refusing proper facilities to its employés to attend Territorial Army camps, was failing to carry out the declared policy of Parliament and the country in regard to national defence.

Eventually a motion that the debate be adjourned in order that the L.P.T.B. might appreciate the strong feeling in the House concerning facilities for the Board's employés to join the Territorial Army was carried by 186 votes to 131.

In the Courts

Claim Against a Gas Manager

Sheriff-Substitute Hamilton, Paisley, has allowed proof in the action for £10,000 brought by Mr. Robert MacLaurin against Mr. John W. McLusky, Glasgow Corporation gas manager. Plaintiff is the inventor of a low-temperature carbonisation plant, and he alleges that a report by respondent conveyed the impression that the process had failed. Respondent denies that he used his influence unjustly to prevent the use of the process. (The hearing of the agents for the parties was reported in our issue of February 18th.)

Winding-up Order

In the Companies' Court on March 7th, Mr. Justice Bennett had before him a petition presented by the Union Cable Co., Ltd., for the winding-up of A. J. Andrews, Ltd., electrical manufacturers, the petitioners being judgment creditors for £479. There was no opposition to the petition and his Lordship made the usual compulsory order.

Sequel to Accident at Old Bailey

Mr. Justice Hawke, in the King's Bench Division on Tuesday, reserved judgment in the action of Bigny *v.* the Corporation of the City of London (F. H. Wheeler & Co., Ltd., third parties), the only question for decision being whether Messrs. Wheeler & Co., electrical contractors, were liable to indemnify the City Corporation for the damages of £1,500 which it had agreed to pay Mr. Alfred H. Bigny, an electrician, for personal injuries he sustained in September, 1936, whilst working for Messrs. Wheeler & Co. at the Central Criminal Court, and £105 costs.

Mr. Bigny fell 72 ft. from a ventilation shaft and sustained very serious personal injuries. It appeared that Messrs. Wheeler & Co. had been called in to complete an installation which a firm of electrical contractors had commenced under a contract with the Corporation and failed to complete within the specified time. At the time of the accident no formal contract had been entered into between the Corporation and Messrs. Wheeler & Co., and they, while admitting that most of terms and conditions contained in the contract between the Corporation and the former contractors could be implied into the new or interim contract with them, said that the one as to indemnification could not. They further contended that the Corporation should not in the circumstances have compromised the claim with Mr. Bigny.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Aberdare Cables

Aberdare Cables is expected to commence production within he next few weeks. The *Financial Times* reports that this company, incorporated in 1935, was formed to establish a factory in Aberdare, Glamorgan, in order to give employment in the Special Areas. The factory covers nearly four acres, and for the present the company will concentrate on the manufacture of paper-covered cables. The company is not a member of the C.M.A. The nominal capital was originally £1,000, but was increased to £200,000 in February, 1937, and to £250,000 in the following month. To the date of the last annual return (March 12th, 1937) 150,000 shares of £1 each had been issued, two fully-paid and 149,998 2s. paid, making the paid-up amount £15,002. Among the principal shareholders at the date of the return were the Bournemouth and Poole Electricity Supply Co., Ltd. (5,000 partly paid shares) and the County of London Electric Supply Co., Ltd. (15,000 partly paid shares). Of the 45,000 shares allotted in April, 1937, payable in cash, the allottees included International Combustion, Ltd. (12,500 shares) and the British Electric Traction Co., Ltd. (5,000 shares). The directors are: Messrs. T. M. Kirby, F. L. T. Barlow (director of Wiggins Teape & Co. (1919), F. G. Penny (director of International Combustion, Ltd.), H. D. Bell, G. C. Usher (managing director, International Combustion, Ltd.), and F. J. Pascoe (director of British Timken, Ltd.).

I.M.E.A. and Standard Cable

The March *I.M.E.A. Journal* says that the Cable Makers' Association recently prepared a draft specification for cables on the assumption that standardisation would result in a reduction in prices. In order that the reduced prices could be calculated it was necessary to obtain approximate information as to the number of authorities who would be willing to purchase cables conforming to that draft specification and, to that end, the I.M.E.A. Council issued a circular to all members. Unfortunately only about 25 per cent. of the members thought it necessary to send a reply. It is stated that unless further support is forthcoming it is unlikely that the attempt to obtain a reduction in cable prices will meet with any material success and those members who have not yet replied are asked to do so at the earliest opportunity so that the Council will know whether there is any purpose in proceeding further with the negotiations.

Philips Lamps New Headquarters

New headquarters are being erected for Philips Lamps, Ltd., on a site of about 15,500 sq. ft. at the northern end of Shaftesbury Avenue, London. The nine floors of the new building will rise to a height of 100 ft., and the main frontage will be on Shaftesbury Avenue. The ground floor frontage will provide ample display windows and showrooms, and the basement floor will offer, among other things, car parking facilities. Designed to the requirements of Philips Lamps,

An artist's impression of the new headquarters of Philips Lamps, Ltd., construction on which has just commenced

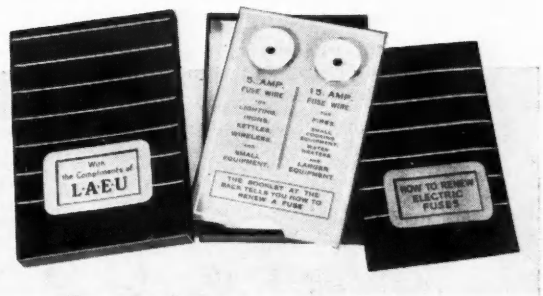
Ltd., by Mr. M. Haigh, of Anns & Haigh, architects, the contract for the building has been placed with Sir Robert McAlpine & Sons (London), Ltd. The building will be ready for occupation by February, 1939.

Australia and British Tenders

At a recent meeting of the Sydney County Council the opinion was expressed that certain British firms tendering for the supply of a switchboard for the Bunnerong power station had "got together" regarding their quotations. The general manager of the Council stated that, in future, prices for electrical equipment would also be sought from German and Swiss firms. Prices quoted for the Bunnerong switchboard ranged from £44,895 to £48,808, and it was decided to accept the tender of £46,410 submitted by the Australian General Electric Co., Ltd., on condition that "negotiations could be opened for a price reduction." It was stated that the estimated cost of the plant, based on a similar purchase in 1936, was £31,000, the present tenders thus representing an increase of 50 per cent. which, according to one councillor, "could not be attributed to rearmament."

London Associated Publicity

A novel and useful form of publicity has been adopted by London Associated Electricity Undertakings, Ltd. This takes the form of two reels of fuse wire (5 A and 15 A) mounted on a metal base, at the back of which is a neatly produced booklet



L.A.E.U. publicity takes the form of fuse wire for light and heavier appliances

telling consumers how to renew a fuse and what can be done in the home for one kWh of electricity. Lists of the various showrooms of the company and of some of the appliances displayed and kept in stock are given.

Sheffield Contractors' Dinner

A hint that Sheffield could anticipate further reductions in electricity charges was made by Mr. J. R. Struthers, general manager and engineer of the Electricity Department, when speaking at the annual dinner-dance of the Sheffield Branch of the Electrical Contractors' Association held at the Royal Victoria Station Hotel, Sheffield, on March 4th. He said that when the extensions at Blackburn Meadows and Neepsend power stations were completed the Corporation would be in a better position than ever to give cheaper electricity. He could forecast a reduction in the near future. Mr. H. E. Walker (president) said that there was evidence of spoliation on the part of certain people whose activities in the trade were undesirable. He wanted the public to realise that buying at low prices did not always represent economy. Alderman W. J. Hunter presided, and the large gathering included the Lord Mayor of Sheffield (Ald. E. G. Rowlinson) and well-known electrical men.

E.D.A. Activities

Gratification at the way electricity was being used on the Team Valley Estate was expressed by Sir Cyril Hurcomb, chairman of the Electricity Commission, who proposed the toast of "E.D.A" at the annual dinner of the Northern Counties Area of the Association on March 3rd at Newcastle-on-Tyne. There were about 200 people present, and Mr. S. Tillotson, borough electrical engineer of West Hartlepool, presided. There would not be a single chimney on the new estate, said Sir Cyril, and all the factories would use electrical power. Last year nearly 13,000,000 tons of coal were consumed in this country by the electrical industry, which was an increase of 1,142,000 tons on the year before. The coal trade could regard the electrical industry as a good and growing customer. While ten years ago an electric cooker was regarded as a curiosity there were now a million of them in use. Mr. A. E. McKenzie, chairman of the Council of E.D.A., said that there was no phase of electrical development in which the Association's influence was not apparent.

Speaking at the annual lunch of the Scottish Area at Edinburgh on March 4th Sir Harry Brittain gave figures showing the extent of the electrical advance in recent years. In this expansion, he said, E.D.A. had played a notable part.

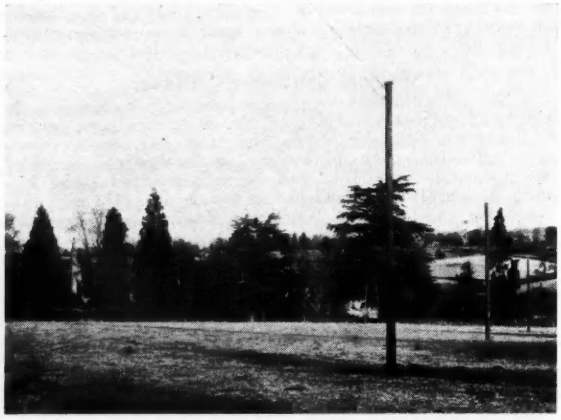
The annual luncheon of the Mid-East England Area was held at the Queen's Hotel, Leeds, on March 2nd, and was attended by over 100 representatives of the electrical industry. The speakers were Messrs. W. Turner, J.P. (Bradford), A. E.

McKenzie (E.D.A. chairman), Prof. E. Roll (Hull University), F. Parkinson (Crompton, Parkinson & Co., Ltd.), and J. N. Waite (Area chairman). The Lord Mayor of Leeds (Ald. Badley) extended a civic welcome to the gathering. Mr. Turner, a former chairman of the Bradford Electricity Committee, said he was a power consumer in his mills, and was now able to compare costs as between electricity and the older method of steam. The advantage lay with electricity. He appealed for greater simplicity in E.D.A. advertising, and congratulated the Association on its past achievements and the position it now occupied in the electrical world. Mr. McKenzie congratulated the Area Committee upon its activity, especially in regard to membership. There were now very few authorities outside the fold. He advised members to make greater use of the specialists on E.D.A. staff. No engineer could claim to be expert in every phase of his task. Professor Roll described the remarkable growth of the industry. The industry was responsible probably more than any other for the displacement of labour by mechanical processes, yet its employment of labour continued to expand. Mr. Frank Parkinson said that, though he was brought up an individualist, he believed that they must be aware of the evils of unrestricted competition. The elimination of wasteful competition would bring advantages all round, not the least of which would be an increased ability to capture the export market. There must be co-operation between manufacturers, but above all as between all sections of the industry. Mr. Waite emphasised the principal feature of the supply service. They must recognise, he said, that they had become a national service. Even the manufacturing section must take this principle into account. If reasonable prices for appliances were available, then the co-operation for which Mr. Parkinson pleaded was the proper policy to pursue. Prizes were presented to the winners in the recent area public-speaking competitions.

One-day exhibitions of domestic electric water-heating apparatus have been held during the current week by the North-West England Area organisation of E.D.A. The first of the series was held on Tuesday last at Preston and was followed by exhibitions at Manchester on Wednesday and at Liverpool yesterday (Thursday). On each day Mr. P. C. Honey has given an address on "Electric Water Heating as a Service to the Community."

Two Church Installations

Electrical installations have recently been completed in two ancient churches in the Midlands. At Peterstow Church, Ross-on-Wye, which dates back to 1066, oil lamps were the only illuminants for many years, but more recently acetylene



The overhead lines leading to Peterstow Church, which can be seen on the left

gas lighting has been used. For the new electrical installation an overhead line nearly 500 yd. long with p.b.j. conductors and ten poles, including two terminal poles, carries the supply from the S. W. & S. Co.'s pole box, where a Henley all-insulated cut-out is installed. The current is metered at this point and there are two road crossings. In the accompanying picture the overhead line appears to be taking a direction away from the church, which is in the left background of the picture. Actually the line takes a turn at the bottom of the field and passes through the vicarage grounds to enter the church. The interior lighting consists of two 150-W and two 100-W floodlights in the chancel and six 100-W lamps in the nave, where the fittings are handsome bronze pendants of period design. Special lamps (six 60-W) are installed for the pulpit and organ and in the vestry. All the wiring is with the Henley wiring system. A lamp is installed at the church gate, and the scheme also included the wiring of the vicarage, the whole cost being borne by an anonymous donor. Messrs. J. H. Batchelor & Co., of Altrincham, were responsible for the installation, including the erection of the overhead line portion. Gawsworth parish church is a fifteenth century building and here the electrical installation consists of Henley v.i.r. in galvanised conduit throughout, the conduit being hidden between the heavy oak roof of the interior and below the exterior tiled roof. Six specially designed fittings of hammered brass, black lacquered, each about 2 ft. diameter and taking three 60-W lamps, are suspended from the oak roof, with chains connecting them to an ornamental bracket. Hidden behind beams in the roof over the chancel are four floodlights, and other lamps are installed for reading desk, organ, pulpit and porch, making thirty-six in all. In the churchyard 150 yd. of Henley lead-covered and armoured cable carries a supply to the lych gate light and to four lanterns on oak posts to illuminate the pathway. The complete installation was by R. Marshall Carr, Ltd., Macclesfield.

C.M.A. Booklet

The Cable Makers' Association has prepared a booklet, which was distributed at the British Industries Fair. It illustrates some of the many applications of C.M.A. cables and contains a list of the members of the Association. An interesting feature is the reproduction of the autographs of founders of the Association written on a menu at a dinner held in 1900, after the ratification of the foundation of the Association.

Aberdeen and the J.I.C.

Aberdeen Corporation Electricity Committee recently agreed to recommend that the Town Council should join the Scottish Joint Industrial Council and the Scottish District Joint Board for the Electricity Supply Industry. One of the effects will be that wage increases will be given to about 400 employés. The extra cost is estimated at £6,359 a year.

Portsmouth Electrical Contractors

The Portsmouth branch of the Electrical Contractors' Association held its annual dinner at the Savoy Café on March 7th, with Mr. L. Shields in the chair. Alderman W. J. Lewis, in his reply to the toast of "The Electricity Department," said that it was time to decide whether public utility undertakings should be run for the benefit of those who use them, or as profit-producing machines. There had been trouble for years in the city over the question of rate aid, and the Electricity Department had been one of the chief sufferers. In the city budget last week, £30,000 was given as the figure to be taken from the Department for the relief of the rates for the coming year. The alderman considered that it was bad finance to budget for this amount for rates until the money was definitely in hand. Tributes were paid to the work of the contractors as the "unpaid canvassers" of the electricity industry.

A Successful Fair

Excellent business and record attendance (156,443, as compared with 152,649) are reported from the Birmingham Section of the British Industries Fair, which closed last Friday. Orders taken and home and overseas contacts made and renewed are said to be generally in excess of those of a year ago, and already many exhibitors have applied for space at next year's Fair, a number of them seeking double display area. Portable tools for small assembly work, automatic polishing machines, washers, cookers and water heaters are among the goods in the Electrical Section for which there has been a keen demand. Holland, Belgium and Scandinavia have sent the largest number of trade buyers from Europe, and Australia, South Africa and New Zealand have been most prominent among Empire buyers. A message from the Earl of Dudley, president of the Birmingham Chamber of Commerce, says that nothing could be more convincing proof of the vitality of British industry than the results at Birmingham, and that there can be no doubt that this has been the most representative display of engineering and hardware products ever brought together.

E.D.A. Salesmanship Certificate

The first examination for the award of salesmanship certificates by the Electrical Development Association was held in January, and the Association has now sent us the results. There were 972 candidates of whom 756 passed; 27 gained distinction by securing 85 per cent. of marks or over. They were: J. R. Allen (London Associated); G. A. T. Burdett (London Associated); W. L. Henderson (London Associated); Miss E. M. Yetton (North Metropolitan E.P.S. Co.); A. W. Gray (Wessex Electricity Co.); E. L. Head (Wimbledon Elec. Dept.); A. B. Metcalfe (London Associated); H. D. W. Allen (North Metropolitan); W. C. Rowsell (Hackney Elec. Dept.); E. A. Tingey (Hackney Elec. Dept.); W. I. Robins (Wessex Electricity Co.); Miss O. Sutherland (North Eastern E.S. Co.); W. L. G. Hetherington (Wimbledon Elec. Dept.); W. J. R. Henson (Wessex Electricity Co.); R. L. Hodgson (Manchester Electricity Dept.); Miss J. M. Cooper (London and Home Counties J.E.A.); R. A. Pockett (London Associated); J. H. Phillips (Cornwall Power Co.); A. L. Roat (North Metropolitan); G. R. Hadley (North Metropolitan); S. T. Jones (Chester Elec. Dept.); Miss E. A. Kane (Antrim Elec. Dist. Co.); J. Hunter (Antrim Elec. Dist. Co.); D. T. O'Regan (Ealing Elec. Dept.); W. R. Horrocks (Lancashire E.P. Co.); Miss K. M. Gastall (Melton Mowbray E.L. Co.); and W. A. Clarke (Mersey Power Co.). Capt. J. C. Chaytor offered prizes (totalling £26) for the students from small undertakings which are members of E.D.A. securing the highest marks. For the national competition these were secured by Miss K. M. Gastall, Miss E. A. Kane and Mr. J. Hunter. For the Central England Area the prizewinners were Miss Gastall, Miss E. A. Kane and Miss E. Brock.

Social Events

The sixth annual staff dance of Brook Motors, Ltd., was held at Huddersfield on February 28th. Over 200 were present, and a number of original ideas ensured an enjoyable evening. Dinner was followed by a short talking picture show, including a film of the staff summer outing, and afterwards whist and dancing continued until 11 p.m. The dance hall was then cleared and a fun fair erected. Everyone was given a perforated card, which authorised one attempt at each game. A prize stall was erected at the end of the hall, and winning coupons were exchanged there for prizes, which ranged from 6d. to 15s. each. Two hundred prizes were given away at the fun fair, and altogether about 250 during the evening. Dancing, interrupted by supper, continued until 2 a.m.

The annual staff dance of T. K. Richardson & Co. was held on March 2nd at Ridgway's Café, Liverpool, when nearly two hundred attended. Novel items included a competition run in conjunction with the E.I.B.A. collection. The prizes were presented by Mrs. T. K. Richardson.

A Works Managers' Association

We have received from Mr. L. M. Angus-Butterworth, Ashton New Hall, Ashton-on-Mersey, Ches, particulars of the "Institution of Works Managers" which is in process of formation. It is proposed that the headquarters shall be in Manchester and that membership shall be limited to men who have had experience and have proved their capacity in works managers' positions. A preliminary letter explaining the scheme has been sent to the managers of many of the most important works in Great Britain and Northern Ireland, and, says Mr. Angus-Butterworth, has met with an encouraging response.

Data on Lighting

In a new booklet entitled "Scientific Industrial Illumination," Holophane, Ltd., has endeavoured to cover the whole field of the subject that is within the province of the works engineer. A practical description of the theory of illuminating systems, which includes tables of foot candle intensities recommended for various purposes and of coefficients of reflection from different surfaces, is given in the earlier part of the book. Later among the applications are examples of lighting by discharge lamps. Among the typical works illustrated are several modern generating stations.

Change of Address

The Cambridge Electric Supply Co., Ltd., has removed its offices to the County Hall, Hobson Street, Cambridge. The company's showroom and Sales Department will remain at 4, Market Hill.

Trade Announcement

The Brush Electrical Engineering Co., Ltd., has appointed Hibro Hollandsch Ingenieurs Bureau, Van Hoeylaan 33, The Hague, Holland, as its representative in Holland and the Dutch East Indies in connection with the sale of its Diesel engines.

Switchgear Publicity

A novel method of demonstrating the constructional details and design of modern e.h.v. switchgear has been devised by J. G. Statter & Co., Ltd. The massive size and great weight of modern e.h.v. switchgear makes the inspection of the constructional details of the actual equipment increasingly difficult. The patent duplicate bus-bar selection incorporated in Statter oil immersion vertical isolation switchgear is unique, and it was considered that the system would be more easily appreciated if it could be seen. A quarter-size working model has therefore been produced which is complete in every detail externally and internally. This allows those interested in the purchase or operation of switchgear to see, operate and, if desired, dismantle any section of the model. An attractive and novel folder has been produced, which invites anyone interested in switchgear to ask for a demonstration of the model.

Egyptian Refrigerator Imports

Household electric refrigerators sold in Egypt are imported from the United States and the United Kingdom. Imports amounted to 274 units, valued at £E5,356, for the eight months ended August 31st, 1937, as compared with 140 units, valued at £E3,094, for the year 1936 and 147 units (£E3,035) in 1935. (The Egyptian pound is worth just a little more than the English pound.) Five leading makes are imported, and prices range from £15 to £22 c.i.f. Alexandria. The most popular sizes have capacities of 4, 6 and 8 cu. ft. (inside space available). Refrigerators for the Egyptian market are treated with "Duco," or a similar product. As a rule no water coil is required and, generally speaking, motors do not have to be specially impregnated as for humid and tropical climates. There is a diversity of voltages in Egypt, so that instructions in this respect must be followed explicitly by shippers. The systems of supply in the principal centres include the following: 100 V single-phase, 40 cycles (centre of Cairo); 200 V, single-phase, 40 cycles (residential section of Cairo); 115 and 230 V, single-phase, 50 cycles, and 220 V, three-phase, 50 cycles (Alexandria); 105-110 V, single-phase, 40 cycles (Port Said); and 220 V, three-phase 50 cycles (Ismailia). Owing to the high cost of electricity in Egypt electric refrigeration has been too expensive for any but the well-to-do. However, a comparatively cheap domestic rate for certain hours of the day has recently been introduced by the power companies in Cairo and Alexandria, which makes it possible for people of more moderate means to afford electric refrigeration. Imported refrigerators are sold by merchants, with exclusive rights, who maintain a store either in Cairo or Alexandria, or stores in both centres, where the refrigerators are sold direct to consumers along with other household electrical appliances. Long-term credits are given by shippers, and merchants, in turn, grant long credit for instalment terms to customers. No organised system of canvassing appears to have been introduced as yet. The customs duty is 17 per cent. *ad valorem*, plus a surtax of 2 per cent., irrespective of country of origin.

Making Tubular Lamps

A note in our issue of February 25th on the tubular lamps produced by the Union Lamp and Lighting Co., Ltd., we gave the diameter as 33 mm.; actually it is 38 mm.

Vacuum Cleaner Publicity

Last week we attended the pre-view of a 1½-hour talking picture programme which has been produced by Hoover, Ltd., in conjunction with South Service, Ltd., to popularise the new Hoover cleaner. The main film "Your Obedient Servant" brings home what the modern household owes to electricity by comparing the manual and electrical methods of cooking, washing, and cleaning as well as electric fires, toasters and coffee percolators. It should, therefore, be useful publicity for supply undertakings and retailers. The film is supplied free, with invitation cards, operator and projection equipment by Hoover, Ltd.

Progress Electrical Co.

In our last issue we recorded the registration of the Progress Electrical Co., Ltd. We are asked by the Progress Electrical Co., 3, Fitzroy Street, London, W.1 (partners Messrs. S. A. Harrowell and E. C. Darby) to state that it is in no way connected with the new company.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price March 9th.	Fortnight's Inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal)... „	£18 10s.	—
a Borax ... ... „	£17	—
a Copper, Sulphate ... ... „	£22 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a „ Perchlorate ... ... „	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a „ Roll... ... ... „	£11	—
a Soda, Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a „ Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b „ Wire ... ... per lb.	1/1 to 1/9	—
b „ Sheet and Foil... ... „	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£177	—
Grade II ... ... „	£125	—
Grade III... ... ... „	£72	—
c Brass (rolled metal 2" to 12" basis)... per lb.	7⅞d.	¼d. dec.
c „ Tubes (solid drawn) ... ... „	11¼d. to 11¾d.	—
c „ Wire, basis ... ... „	8¼d.	—
c Copper Tubes (solid drawn) ... ... „	1/0½	—
g „ Bars (best selected)... ... per ton	£75	—
g „ Sheet... ... ... „		
g „ Rod ... ... „		
d „ (Electrolytic) Bars ... ... „	£44 17s. 6d.	£1 2s. 6d. inc.
d „ „ Wire Rods ... „	£49 17s. 6d.	£1 2s. 6d. inc.
d „ „ H.C. Wire ... per lb.	7⅛d.	⅛d. inc.
f Ebonite Rod ⅛" dia. & up ... ... „	1/10 to 2/5	—
f „ Sheet ⅛" thick & up ... ... „	1/5 to 1/10	—
n German Silver Wire, Nos. 1 to 12... „	2/4	—
h Gutta-percha, fine ... ... „	nom.	—
h India-rubber, Para-fine ... ... „	6d.	—
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s.	—
i „ Wire galv. No. 1 P.O. Qual.... „	£23	—
g Lead, English Pig ... ... „	£17 5s.	10s. dec.
g Mercury ... ... per bot.	£12 15s.	2s. dec.
e Mica (in original cases) small ... per lb.	10d. to 2/–	—
e „ „ „ medium ... „	6/– to 12/6	—
e „ „ „ large ... „	13/– to 17/6 up	—
p Phosphor Bronze, plain castings ... „	1/2½	—
p „ „ drawn bars & rods „	1/1½	—
p „ „ rolled strip & sheet „	10⅝d.	—
p „ „ wire ... ... „	1/0½	—
o Platinum ... ... per oz.	£7 10s.	10s. inc.
d Silicium Bronze Wire ... ... per lb.	8⅛d.	¼d. inc.
g Spelter ... ... per ton	£14 1s. 3d.	15s. dec.
g Tin, Block (English)... ... ... per ton	£185 10s.	£1 10s. dec.
n „ Wire, Nos. 1 to 16 ... .. per lb.	4/3	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

New Catalogues and Lists

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, London, W.C.2. —A broadsheet relating to the company's forthcoming publicity drive.

Venner Time Switches, Ltd., New Malden, Surrey.—A leaflet announcing the approval by the Electricity Commissioners of Venner meters.

H. J. Scott & Co. (Belfast), Ltd., Volt Works, Ravenhill Avenue, Belfast.—A stock list of "Scott" motors.

Croydon Engineering Co., Ltd., Syncroy Works, Commerce Way, Purley Way, Croydon.—A catalogue of geared fractional h.p. motors.

R. F. Winder, Ltd., Belgrave Electrical Works, Leeds, 2.—A stock list of new and second-hand electrical material.

Time Switches & Instruments, Ltd., 120, Victoria Street, London, S.W.1.—Details of a new short-period time switch with silent operation.

Wardle Engineering Co., Ltd., Old Trafford, Manchester.—Catalogue No. L.31, describing lanterns for use with both mercury and sodium discharge lamps. Coloured illustrations give realism to the illustrations.

Rawlplug Co., Ltd., Cromwell Road, London, S.W.7.—A leaflet dealing with "Kango" hammers which the company is now distributing.

Combi Electric Co., Ltd., 85, Cromwell Road, London, S.W.7. —A leaflet describing s.p. and d.p. circuit-breakers for small motors.

Bankruptcy Proceedings

F. F. C. King, 235, Banbury Road, Oxford, and 55, High Street, 87, St. Aldates and 226, Cowley Road, Oxford, radio trader.—The public examination herein was to have been held at the County Hall, New Road, Oxford, on February 28th, but the Official Receiver said that as the trustees were not in a position to examine, he did not propose to open the proceedings. The examination was adjourned.

J. W. Collier, Radio Stores, 3, Heybridge Street, Heybridge, Maldon, Essex, radio dealer.—The public examination was held at the Shire Hall, Chelmsford, on March 2nd, when it was stated that there was a deficiency of £406 on liabilities of £531. The examination was adjourned.

D. Freeman, radio dealer, 54, Whitchurch Gardens, Edgware. —This debtor attended the London Bankruptcy Court for his public examination before Mr. Registrar Kean on March 2nd. His statement of affairs disclosed liabilities of £327 but described the assets as uncertain. The debtor attributed his failure to lack of trade through opening premises for the business in an unsuitable neighbourhood, to loss in connection with an invention, and to loss on resale of certain goods purchased abroad. The examination was concluded.

J. T. Southwood, 13, Brandreath Road, Compton, Plymouth, lately carrying on business at Belgrave Garage, Mutley, Plymouth, electrical engineer.—This debtor's public examination took place at the Western Law Courts, Guildhall, Plymouth, on February 25th. It was reported that there was a deficiency of £2,638 on liabilities of £2,647. Debtor attributed his present position to heavy competition from unskilled electricians, multiple stores, and the operation of hire-purchase schemes, and he alleged that an employé had kept from £50 to £70 which he had been paid for insurances, and had also not paid over money collected on accounts. The Official Receiver said that most of the book debts were disputed, and he asked debtor whether this was due to the alleged defalcations of his employé. Debtor replied that he thought it was. He added that his effects had been sold under an execution about six months ago, and he had since been employed as a fitter at the Dockyard. The examination was closed.

R. D. Farrant, radio dealer, 196, Archway Road, Highgate, London, and lately trading at the rear of 543, Holloway Road, London.—Receiving order made February 25th on a creditor's petition. Public examination April 6th at Carey Street, W.C.2.

F. H. Steiner (Hants Electrical Utilities Co.), dealer in household electrical necessities, 6b, Northam Road, Southampton.—Receiving order made February 23rd on a creditor's petition.

J. H. Dollittle, 35, Queen's Road, Farnborough, Hants, and lately trading at 145, Victoria Road, Aldershot, under the style of the Zenith Radio Manufacturing Co.—Public examination April 5th at the Guildhall, Guildford.

M. Healey, radio dealer, 51, Broomhill Road, Bulwell, Nottingham.—Public examination April 7th at the County Court House, Nottingham.

G. C. Spong and **J. H. Trussell** (C.C.S. Trading Co.), electricians, 30, Western Mail Chambers, Cardiff. (Separate application of G. C. Spong).—Discharge of G. C. Spong, subject to consent to judgment for £50 and £1 10s. costs of judgment. (Consent given.)

N. Millard, wireless, cycle and electrical engineer, 1, Mercatoria, St. Leonards-on-Sea.—Trustee, Mr. V. R. Fletcher, 8, Old Steine, Brighton, Official Receiver, released February 18th.

J. L. Sylvester, radio engineer, 53, Ellers Road, Harehills, Leeds.—Trustee, Mr. H. C. Bowling, 24, Bond Street, Leeds, Official Receiver, released February 17th.

B. G. Wright (Wright's Electrical Co.), electrical engineer, 15, Hounsfield Road, Sheffield.—Trustee, Mr. E. Smith, Queen's Buildings, Queen Street, Sheffield, Official Receiver, released February 16th.

L. C. Rowse, radio and electrical engineer, 20, Western Place, Penryn, Cornwall, formerly trading at 60, Lower Market Street, Penryn.—First and final dividend of 1s. 7½d. in the £, payable March 7th at 12, Princes Street, Truro.

Company Liquidations

Coates & Co. (Harrogate), Ltd., electrical factors, 34, Victoria Avenue, Harrogate.—A meeting of creditors was held recently, when a statement of affairs was submitted showing liabilities of £3,472. The net assets were £606, leaving a deficiency of £2,866 so far as the creditors were concerned. The debenture holder, who was also the cash creditor, stated that he was prepared to withdraw his claims against the company until the other creditors had received 10s. in the £. A resolution was passed confirming the voluntary liquidation of the company with Mr. S. T. Milner as liquidator, and a committee was also appointed.

Musgrove & Johnson, Ltd., radio and electrical engineers, 331-333, Shirley Road, Southampton.—A meeting of creditors of the above was held recently, when the statement of affairs disclosed liabilities of £1,370, of which £970 was due to the trade and the balance of £400 to a cash creditor. The net assets were £351, leaving a deficiency, as regarded the creditors, of £1,019. The creditors decided to confirm the voluntary liquidation of the company with Mr. H. J. Weeks, of Portland Terrace, Southampton, and Mr. C. Latham, of 185-188, High Holborn, London, W.C., as joint liquidators, and a committee was also appointed.

Churchman's Electric & Radio Factors, Ltd.—Particulars of claims by March 19th to the liquidator, Mr. T. G. Piper, Bush Lane House, Cannon Street, E.C.4. Meetings April 8th at Bush Lane House, Cannon Street, E.C.4, to receive an account of the winding-up by the liquidator.

Plymouth Radio Finance Co., Ltd.—Winding-up voluntarily. Liquidator, Mr. W. H. Perry, 1, St. Andrew Street, Plymouth.

Meeting of Creditors

Warner's Radio & Electric, Ltd.—A largely attended meeting of creditors was held on March 3rd at Winchester House, Old Broad Street, London, E.C. An approximate statement of affairs as at February 19th last had been prepared which showed ranking liabilities of £80,356, all due to unsecured creditors. The assets totalled £312,664, and they were estimated to produce £171,062. From the latter amount had to be deducted £23,102 for preferential claims, leaving net assets of £147,960, or a surplus, so far as the creditors were concerned, of £67,604. With regard to the amounts due by subsidiary companies, the statement showed that £132,501 was owing by Rawire, Ltd., and £818 by Lawsons Cycle & Sports, Ltd. Of the investments in subsidiary companies £1,250 was in Rawire, Ltd., and £8,146 in Lawsons Cycle & Sports, Ltd. The issued capital of the company was 120,000 cumulative preference shares of 10s. each and 2,300,000 ordinary shares of 1s. each, all fully paid. So far as the preference shareholders were concerned there was an estimated surplus of £7,604, subject to the costs of liquidation. With regard to the ordinary shareholders, however, there was a deficiency of £107,396. The chair was occupied by Mr. C. F. Hitchins, who stated that no resolution had been passed at the shareholders' meeting. After giving particulars leading up to the present meeting of creditors, the chairman invited questions, and one creditor asked what the position was with regard to the suggested offer which had been made by J. & F. Stone. The reply was that there had been no direct negotiations. Mr. H. Rainsbury, the accountant, said that the loss of over £100,000 which had been sustained during the last 4½ months was due to the disastrous state of the radio trade. Mr. P. Houston said that there was a petition on the file for the compulsory winding up of the company, and if such a course were adopted it would be fatal to the company and the creditors. Mr. C. Latham agreed, and said that as recently as the previous Friday, but for the assistance of the largest creditors, the business would have collapsed. For the last few weeks the wages, &c., had been paid other than out of the company's resources. A resolution was passed by a majority in favour of the appointment of Mr. C. Latham, of 185/8, High Holborn, London, W.C., as liquidator, and a committee of five of the creditors was nominated. The following are the principal creditors:— A. J. Balcombe, Ltd., £1,677; Beautility Furniture, Ltd., £1,020; E. K. Cole, Ltd., £6.112; A. C. Cossor, Ltd., £1.070; Ever-Ready Co., Ltd., £11,405; G.E.C., Ltd., £3,901; Lebus Harris, £6,836; Levi & Sons, £1,123; Marconiphone Co., Ltd., £3,509; S. Rich, £1,250; Thorn Electrical Industries, Ltd., £11,349; and Ultra Electric, Ltd., £6.624.

The directors announce that they have been advised that owing to a technical irregularity at the meeting of shareholders adjourned for the purpose of taking a poll, no effective resolution to put the company in liquidation was passed. The resolution passed, therefore, at the meeting of creditors was not operative. Steps have been taken to convene another meeting of shareholders on Wednesday next, which will be followed by a meeting of creditors.

Private Arrangements

D. R. Stringer and **F. B. Thomas,** trading as Stringers, Brunswick Road, Shoreham-by-Sea, wireless and electrical dealers.—The creditors were called together recently at Brighton when a statement of affairs as at February 26th last was submitted, showing liabilities of £1,051. The net assets were £238, leaving a deficiency of £813. A note appended to the statement of affairs stated that there was a contingent liability to a finance corporation of £502 in respect of hire-purchase assignments subject to an unknown reserve to be liquidated when the hire-purchase contracts were discharged. It was stated that debtors had no private assets, and they could not make any offer to the creditors. It was resolved that a deed of assignment should be executed in favour of Mr. A. W. Dalling, C.A., 1, Pavilion Buildings, Brighton, as trustee, with a committee of inspection including Mr. C. Latham, accountant, 185, High Holborn, W.C., representing several creditors.

J. F. Norman, trading as "Norman's," radio dealer, Cross Street, Sale.—The statement of affairs submitted at the recent meeting of the creditors showed liabilities of £604, of which £204 was due to the trade and £400 to a cash creditor. There were also fully secured creditors for £31. The net assets were £62, leaving a deficiency of £542. There was a footnote to the statement to the effect that there might be contingent liabilities in respect of hire-purchase transactions. It was decided that, subject to debtor's father withdrawing his claim of £400, the estate should be administered under a letter of authority.

S. Joseph, electrical engineer, 39, Pembroke Place, Liverpool.—At a recent creditors' meeting the statement of affairs showed ranking liabilities of £181. The net assets were £33, leaving a deficiency of £148. An offer was made of a composition of 4s. in the £, which it was decided should be accepted.

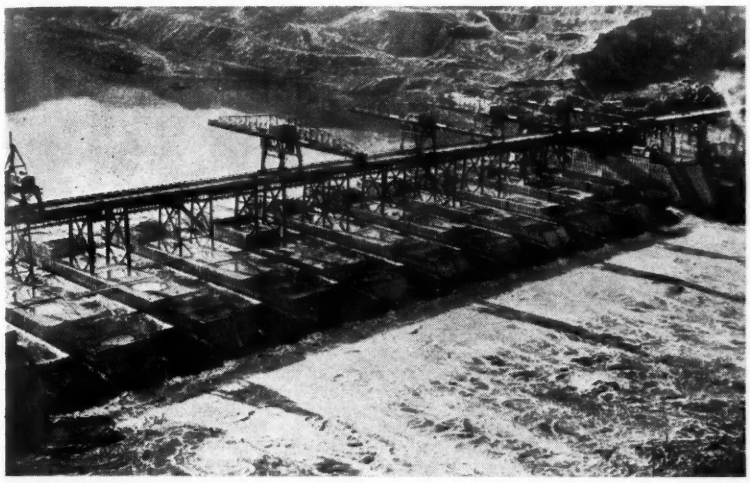
Electricity Supply

Lighting, Domestic, Power

Ardrossan (Ayrshire).—COMPENSATION FOR TENANTS.—The Housing Committee has decided that tenants who have installed electricity in municipal houses at their own cost shall be paid £6, or the amount actually incurred if less.

Ashford.—LIGHTING EXPERIMENTS.—Sodium and mercury lamps are being installed experimentally at two important road junctions with a view to deciding on improvements to street lighting generally.

Barrhead (Renfrewshire).—CONTROL OF STREET LIGHTING.—The Town Council is experimenting with central control of lighting, equipment having been put into operation for trial purposes by the Automatic Telephone and Electric Co., Ltd.



The base of the dam which is being built on the Columbia River in connection with the Grand Coulee hydro-electric and irrigation scheme—one of the largest ever attempted. Some 300 ft. is still to be added to the dam. Water will reach the turbines through 18-ft. penstocks under an average head of 335 ft.

Bathgate.—REQUEST FOR ELECTRICITY.—Application has been made by the Town Council to the Scottish Midlands Electricity Supply, Ltd., for cables to be laid for supplies to municipal houses.

Blackpool.—SERVICES.—Services are to be laid to each of the 148 houses on the South Shore housing estate not already provided with electricity.

ILLUMINATIONS.—A sum of £25,000 has been allocated by the General Purposes Committee for the autumn illuminations.

Bridlington.—LOAN.—Application is to be made for sanction to borrow £3,500 for new equipment in Cardigan Road to maintain the voltage.

Brighton.—CHEAPER STREET LIGHTING.—As from April 1st the charge for electricity for street lighting is to be reduced to 0.9d. per kWh up to midnight and 0.25d. per kWh from midnight to dawn.

SUB-STATION.—The Committee is to provide sub-station equipment at Beechwood Avenue, Withdean, at a cost of £7,372.

INSTALLATION IMPROVEMENT.—The Public Assistance Committee has approved a scheme for the improvement of the electrical installation in part of the Elm Grove Home at an estimated cost of £400.

Bristol.—SUB-STATION.—The Electricity Committee is to erect a sub-station on the Knowle estate in Wedmore Vale.

Burton-on-Trent.—RURAL SUPPLIES.—The Town Council is opposing the application by the Derbyshire and Nottinghamshire Electric Power Co. for powers to supply electricity within the parishes of Calke, Derby Hills, Ingleby, Smisby, Stanton-by-Bridge and Ticknall. The Council has decided to apply for a Special Order authorising the Corporation to serve these parishes.

Cardiff.—CHURCH HEATING.—The Electricity Committee has decided that a heating flat rate of ½d. per kWh throughout the year shall be applied to all churches and chapels in the city.

ELECTRIFICATION OF MILLS.—Thomas Owen & Co., Ltd., Ely Paper Mills, are engaged upon the electrification of their plant and shortly all the machinery will be electrically operated. A new 3,500-kW Metropolitan-Vickers turbo-alternator has been installed.

Carlisle.—ELECTRICITY IN COUNCIL HOUSES.—The City Council is to install electricity in 224 houses at Currock and 286 at Petteril Bank.

Cheltenham.—SUPPLY EXTENSIONS.—At a cost of £215 the Electricity Committee is to provide a supply to Gotherington Cross. Sanction has been obtained to borrow £7,053 for the extension of mains in Charlton Kings and Leckhampton.

Clitheroe.—SUPPLY EXTENSIONS.—Arrangements have been completed by the Electricity Department to carry a supply beyond Hurst Green towards Longridge and to farms in the neighbourhood of Sawley, Bolton-by-Bowland and Gisburn. Negotiations are proceeding for further extensions.

Coventry.—MAINS AND EQUIPMENT.—The Electricity Committee is seeking sanction to borrow £88,109 for mains and equipment.

Crowborough.—ALTERNATIVE SUPPLY.—At a recent meeting of the Parish Council a letter was received from the Weald Electricity Supply Co., Ltd., stating that it had decided to run a new feeder from Tunbridge Wells to Crowborough, thereby giving an alternative supply, it was hoped, before next winter.

Culcross.—PROPOSED ELECTRICITY SUPPLY.—The Fife Power Co. proposes to extend its mains to Kincardine-on-Forth, and these will be connected with Culross. Houses and factories are being wired for light and power.

Dartford.—CABLES.—At a cost of £1,876 the Electricity Committee is to lay a cable between the electricity works and the Temple Hill sub-station. The Committee is also to extend its main to the Heath Farm estate at a cost of £458.

Daventry.—EXTENSIONS.—The Northampton Electric Light & Power Co., Ltd., proposes to supply electricity to Upper and Lower Weedon, near Daventry.

Derbyshire.—RURAL SUPPLIES.—Requests for a supply of electricity for Edale and Millers Dale, Derbyshire, have been made to the Derbyshire & Nottinghamshire Electric Power Co.

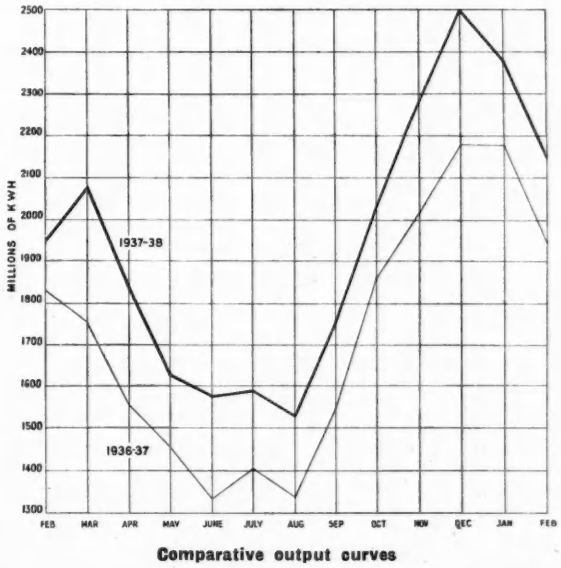
Devizes.—MAINS EXTENSIONS.—Approval has been given by the Rural District Council to plans submitted by the Wessex Electricity Co. for extensions of the low-voltage overhead lines at Seend, Littleton Panell and West Lavington.

Eastbourne.—MAINS.—Extensions of mains costing £373 are to be carried out by the Electricity Committee to supply twenty-six houses on the Upperton estate.

Enfield.—CHANGE-OVER.—Owing to an increase in the d.c. load in Churchbury Lane the North Metropolitan Electric

Generation of Electricity in February

OFFICIAL returns rendered to the Electricity Commissioners show that 2,144 million kWh was generated by authorised undertakings in Great Britain during February as compared with the revised figure of 1,944 million kWh in the corresponding month of 1937, representing an increase of 200 million kWh or 10.3 per cent. The number of working days in the month (*i.e.*, excluding Sundays) was twenty-four, the same as last year.



Comparative output curves

During the two months of 1938 up to the end of February the total quantity of electricity generated by authorised undertakings was 4,527 million kWh as compared with the revised figure of 4,121 million kWh for the corresponding period of 1937, representing an increase of 406 million kWh, or 9.9 per cent.

Power Supply Co. is to change over the system at an early date. The company estimates the cost at £5,603.

Eston.—SUPPLY TO BRICKWORKS.—A supply of electricity is to be given by the Electricity Committee to the South Bank brickworks of Crossley & Sons, Ltd.

STREET LIGHTING.—The street lighting is to be improved at a cost of £2,252.

Glossop.—OWNERSHIP OF UNDERTAKING.—For some time negotiations have proceeded between the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board and the Urban Electric Supply Co., Ltd., for the acquisition by the Board of the Company's undertaking as Glossop. These negotiations were recently suspended, but, according to the *I.M.E.A. Journal*, they have now been resumed. The position has been explained to the Town Council by a deputation from the Board, and the Council has passed a resolution viewing the transfer with favour. For geographical and community of interest reasons it prefers the undertaking to be grouped with the Joint Board rather than with Group 18 in District III of the Ministry of Transport's "Outline of Proposals," and if such acquisition is effected it will waive any option to purchase that might be vested in the Corporation. It considers that the scheme should be proceeded with without delay.

Guildford.—EXTENSIONS.—Owing to the heavy increase in the demand on the Onslow village estate and the continued growth of the load by the installation of large numbers of domestic appliances the Electricity Committee has found it necessary to extend the high-voltage mains for 444 yd. It is also proposed to erect a transformer of 300 kVA capacity in a kiosk on a suitable site. The cost is estimated at £800.

Hazel Grove and Bramhall.—NEW EQUIPMENT.—The Electricity Committee has approved a report by the engineer and manager regarding the installation of automatic voltage-control equipment, including a scheme for the transfer of the existing extra-high-voltage switchgear from the Chapel Street sub-station and the installation of additional equipment at Chapel Street, at an estimated cost of £9,860. Application is being made to the Electricity Commissioners for sanction to borrow the following amounts: Switchgear, £5,400; mains, £1,500; and sub-station at Bridge Lane and extending offices and stores at Chapel Street, £2,960.

Inverness.—HIGHLAND SUPPLIES.—The question of electricity supplies in the Highlands was considered by the County Council last week following discussions with the Electricity Commissioners regarding the Grampian Co.'s proposals for supplying certain areas in the Great Glen. The Commissioners suggested that the Council should renew its representations after the fate of the Caledonian Power Bill was known. The Council agreed to continue its opposition to the Grampian Co.'s proposals.

At the same meeting the County Council approved the final agreement with the British Oxygen Co. regarding the Caledonian Power Bill. The agreement is designed to safeguard the county's interests in rating, employment, amenity, and electricity. It was stated that the company had agreed to supply electricity to hamlets far from the main cables by means of oil engines.

Keighley.—STREET LIGHTING.—The Highways Committee has approved a scheme for lighting Bradford Road at a cost of £1,628.

Kettering.—RURAL SUPPLY.—The Electricity Department is to extend the overhead lines from the main road to Stoke Park Farm, Stoke Albany, the Rural District Council having given the necessary consent.

Leeds.—PLANT MODERNISATION.—The Health Committee has appointed Mr. F. J. H. Wilson, consulting engineer, to prepare a report on the subject of modernising the power plant at Seacroft Hospital.

Lincoln.—REDUCED CHARGES.—A reduced scale of electricity charges has been approved by the City Council. The new tariff will mean an annual reduction in revenue of £6,586.

London.—ST. PANCRAS.—Following the successful installation of Siemens 400-W "Sieray" lamps in "Regent-Sieray" lanterns in Euston Road, the Borough Council has installed similar units for the lighting of Hampstead Road, an important thoroughfare linking the junction of Tottenham Court Road and Euston Road with High Street, Camden Town. There is excellent visibility, not only over the carriageway, but also the footpath.

SOUTHWARK.—The Electricity Committee reports that in March, 1937, it accepted the quotation of the Metropolitan-Vickers Electrical Co. for the replacement of the existing No. 4 generating set at the power station by a new turbine and generator. As this proposal involved an increase in the capacity of the plant, application was made to the Electricity Commissioners for sanction, but the Commissioners intimated that they were unable to give their decision until they had held a public inquiry into the matter. The Electricity Committee has now given further consideration to the matter and is advised that, in view of a recent decision of the Commissioners in similar circumstances, and having regard to the present policy of "nationalisation" and unification in the industry, it is unlikely that the Commissioners will give their consent to this proposal.

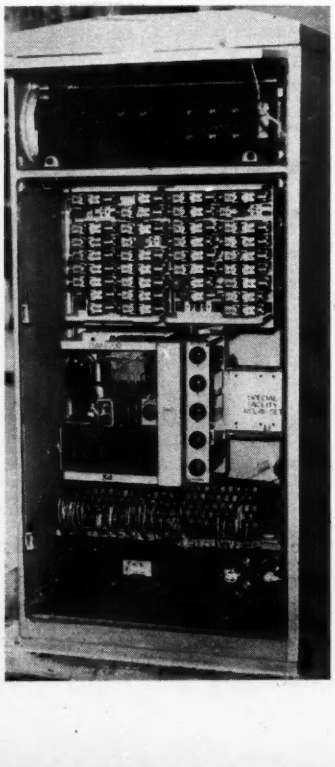
STOKE NEWINGTON.—The Town Hall Committee has adopted a scheme for improving the lighting arrangements for the stage and dance floor of the Public Assembly Hall by introducing coloured lighting and installing new footlights, &c. The estimated cost of the scheme is £420.

Mansfield.—SUB-STATION.—The Electricity Committee is to erect a sub-station in Titchfield Park at an estimated cost of £750.

Macclesfield.—ACQUISITION OF UNDERTAKING.—At a recent meeting of the Electricity Committee the Town Clerk reported

Traffic Control with "Phase Conversion"

SO that the various traffic flows shall be segregated and handled according to their direction, a system of "phase conversion" is incorporated in the new "Autoflex" system inaugurated at Exeter by the Minister of Transport, Dr. Leslie Burgin. This varies the sequence of signal indications in an appropriate manner to meet the demand of the traffic flowing at particular periods. Phase conversion, of which this is the first application, enables the traffic flow to be controlled at each intersection by dividing it into two or three streams. A typical case is that of Queen Street, the key intersection, where during two-phase control filtration of "right" turning traffic is permitted while traffic on both sides of High Street is moving. This phase is then followed by Queen Street. During periods of dense traffic the two sides of High Street move in two separate traffic phases, allowing free movement of turning traffic. This is then followed by Queen Street as the third phase. These refinements are provided in addition to normal facilities given by standard methods of vehicle actuation. In order to increase the benefits of phase conversion, two separate setting fields are provided at the master controller, and a traffic integrator is specially equipped to perform the selection of the correct phasing in addition to its normal duties of assessing the volume of traffic and altering the cycle time. The controlled area consists of five intersections in High Street and a separate pedestrian crossing at St. Stephen's Bow. The pedestrian crossing is equipped with signals operated by push buttons for the use of pedestrians, and with vehicle detectors for road traffic. In addition, both sides of the bridge over the River Exe are also controlled, the two intersections being co-ordinated by a master timer unit with traffic integrator similar to the one employed for the High Street scheme but without the facility of phase conversion. All the functions are performed by means of relays, except three rotary switches in the master controller.



A typical local controller

It is essential that the periods timed by the master and local controllers should be of extreme accuracy, and to ensure that these timings are not affected by any voltage fluctuation on the mains supply all controllers are equipped with an "Autoflex" voltage stabilising power unit. The scheme was devised by officials of the Ministry of Transport, and the equipment was designed and installed by the Siemens & General Electric Railway Signal Co., Ltd.

Metallic Resistance Materials

B.S.S. No. 115, dealing with metallic resistance materials for electrical purposes, first published in 1921 and revised in 1924, has again been revised. Important changes have been made in connection with the permissible variations in the resistance of wire, sheet and strip, the British Standard covering normal requirements. The table of standard sizes has been omitted, since it has not been generally adopted, the great majority of users preferring the s.w.g., b. and s., and millimetre sizes, which are given in an appendix for reference. Another important difference is the omission of life tests for classes D and E materials (for use at temperatures exceeding 850 and 1,050 deg. C., respectively) which are receiving further study.

upon the provisions of the Macclesfield Electricity Order, 1911, with regard to the Corporation's powers to purchase the part of the undertaking of the Electricity Company of Macclesfield, Ltd., in the borough. It was resolved to obtain information as to the probable cost of acquiring the undertaking.

Morecambe and Heysham.—ILLUMINATIONS.—The borough electrical engineer and borough treasurer have reported that the 1937 autumn illuminations scheme, involving a cost to the Advertising Committee of £9,485, produced a credit balance of £2,757, the Electricity Committee contributing £5,650 to this result. The balance is transferred to the credit of the 1938 illuminations. This, according to the electrical engineer's proposals, will involve an expenditure of approximately £13,568, against which direct revenue of about £6,000 is expected from Happy Mount Park and the Swimming Stadium, which, with the 1937 balance and £500 from loan and sale of illumination materials, will leave £4,311 to be obtained from other sources. The Electricity Committee has expressed itself willing to pay £2,700 towards the 1938 scheme.

Motherwell.—LOANS.—Sanction is to be sought to loans of £20,000 for mains and services, and £10,000 for meters.

Newcastle-on-Tyne.—ELECTRICITY CHEAPER.—Revised electricity charges are announced by the North-Eastern Electric Supply Co., Ltd., to come into force in April. In Newcastle and Gateshead the final rate in the domestic sliding-scale tariff and the "unit" rate in the two-part tariff will be reduced from ¾d. to ½d. a kWh. The same reduction will apply to all the company's areas except the outlying districts, where the primary rate is reduced to 5½d. in cases where is exceeds this figure. These and other reductions will affect 22,000 consumers in Newcastle and about 250,000 throughout the area.

Perth.—LANDLORDS AND ELECTRICAL INSTALLATIONS.—The Perth Landlords' and Property-Owners' Association is recommended by a committee not to consent to electricity being installed in tenement properties unless it is satisfied that the electric wiring comes up to the proper standard of safety. In the committee's opinion the installation of electricity is an operation that affects the safety of the building from the point of view of fire, and it considers that the landlord should be consulted. It points out that the Courts have decided that the Glasgow Electricity Department is not entitled to install electricity without the consent of the property owner.

Petham (Kent).—SUPPLY INAUGURATED.—Electricity has now been introduced into the village.

Pontefract.—SUB-STATION.—The Yorkshire Electric Power Co. is to erect a sub-station at Carleton Park.

Portsmouth.—MAINS.—The Electricity Committee is seeking sanction to borrow £35,000 for mains extensions.

Sheffield.—MAINS.—The Corporation has approved extensions of electricity mains at a cost of £3,206.

South Africa.—DURBAN.—A second large power station is to be erected at Congella, and an additional 30,000-kW set has been ordered for the existing Congella station. The total capacity of the two stations will be 140,000 kW. Consumption in Durban is increasing at a rate only surpassed on the Rand, and with the inauguration of further electrified sections of the railway in Natal the additions are a matter of urgency. The policy of the Electricity Supply Commission is not to continue indefinitely enlarging the size of stations, but to duplicate them in order to minimise the risk of breakdowns and to allow interlinking. Further additions are to be made to the supply systems along the south coast, which at present extend as far as Umkomaas and Scottburgh. The whole north coast will also in due time be served from Durban. The present Congella station has been repeatedly enlarged. It dates back to the early days of the Electricity Supply Commission, and is nearly fifteen years old. Its output is sold under contract in bulk to the Durban City Council as well as to other municipalities. Some two or three years will be required for the erection of the new plant, and the cost will exceed £2,000,000. Cooling water will probably be taken from the sea, as is the case with the Cape Town plant at Salt River.

Southampton.—COAL CLAUSE MODIFICATION.—The Electricity Committee is recommending an alteration in the adjustment for variation in the cost of coal. This is to ease the burden of increased charges for electricity to consumers taking a bulk supply, due to recent increases in the cost of coal. It is estimated that this will cost the Department £9,097 in the coming year.

South Shields.—REORGANISATION SCHEME.—The Town Council has received permission to borrow £37,000 in connection with the second year's instalment of the scheme for reorganising the electricity undertaking, and to a loan of £5,000 in connection with the hire and hire-purchase scheme.

GAS SCHEME REJECTED.—A motion to install gas for washing purposes in new houses on the Little Horsley Hill estate, outside the Council's area of electricity supply, was defeated at a recent meeting of the Town Council, although a private company and not the Corporation will benefit. It was pointed out, however, that of 300 tenants on the estate only 140 had signed a petition for gas.

SUB-STATION.—Permission has been received by the Council to borrow £7,200 in connection with work at sub-stations at Dean Road, Tyne Dock and the Marine Park.

West Lancashire.—RURAL AREAS AND RATE RELIEF.—At a recent meeting of the Rural District Council, Mr. Lewis referred to the fact that he had seen it announced recently that the Liverpool electricity undertaking had contributed £70,000 to the Liverpool rates. He asked if that should not be applied to reductions in charges as a great deal of the electricity was consumed outside the city. It was not right for the Liverpool Corporation to exploit the outside districts and appropriate all the profit to the reduction of their own rates. It was agreed that the clerk should pursue inquiries.

Worthing.—SUPPLY EXTENSIONS.—The Electricity Committee is seeking sanction to borrow £2,177 for cables to Sompting. A supply is also to be given to Ferring sewage pumping station at a cost of £1,550. Arrangements have been concluded between Sir Charles Price and the Electricity Committee for a supply to be given to the Field Place estate at a cost of £1,155.

Tonbridge.—SHOP-WINDOW LIGHTING TARIFF DISCONTINUED.—In spite of a protest by the Chamber of Trade, the Electricity Committee has decided to discontinue the special shop-window lighting tariff as from March 31st next.

Traction

Cardiff.—CHOOSING A NEW TRANSPORT SYSTEM.—The question of whether oil-engined buses or trolley-buses shall take the place of the trams was again discussed at a special meeting of the Transport Committee last week. It was decided to call for further reports dealing with the possible raising of bridges, lowering of roads, fumes from Diesel-engined buses, and the feasibility of running an experimental service of trolley-buses.

One of the new trolley-buses at Holborn Circus

London.—NEW TROLLEY-BUS ROUTES.—Besides being the largest change-over from trams to trolley-buses yet carried out in one day by the London Passenger Transport Board, last Sunday's conversion brought trolley-buses into the City for the first time. Altogether, 23¾ route miles were added to the trolley-bus services. Whereas the trams terminated at Gray's Inn Road and Farringdon Road, the trolley-buses connect from one to the other *via* Holborn Circus. The new trolley-bus routes serve, among other places, Barnet, Finchley, New Southgate, Wood Green, Highgate, Moorgate, King's Cross and Holborn. The additional 93 vehicles introduced brings the total in operation to over 700.

RAILWAY SHAREHOLDERS AND ELECTRIFICATION.—At a luncheon given by the British Railway Stockholders Union, Ltd., in London on Tuesday, Mr. R. Holland-Martin, chairman of the Southern Railway, said that the company could justly claim to have increased, through its electrification policy, the area covered by "dormitory" towns around London. Main lines electrified by the company in the last five years had involved expenditure on capital account of £4,500,000. Although train miles operated had been more than doubled, the working expenses had not appreciably increased. Receipts, however, had risen by £640,000 a year, representing a return of about 14 per cent. on the capital expenditure. Though these rich results were not always to be expected, they would continue to be satisfactory if there was no sharp fall in the population.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Abertillery.—March 17th. Electricity Undertaking. Lamps in connection with change-over from d.c. to a.c. (March 4th.)

Aberystwyth.—March 15th. Electricity Department. Meters for three years. (February 25th.)

Aldershot.—April 5th. Electricity Department. Cable and meters for twelve months. (See this issue.)

Australia.—MELBOURNE.—March 29th. Deputy Director, Posts and Telegraphs. Telegraph milliammeters. (T. 18422/38.)*

Birmingham.—March 18th. Public Assistance Committee. Electric lighting and power installations and fire alarms for Birmingham Infirmary, Town Clerk's Office, Room 11A, Council House (deposit £2 2s.).

Blackpool.—March 14th. Borough Council. One raking screen, together with electric motor, starting gear and all necessary accessories, for Lennox Gate pumping station. Town Clerk, Town Hall (deposit £1 1s.).

March 17th. Three 500 g.p.m. vertical-spindle centrifugal pumps with electric motors, starting gear and accessories for Claremont Bath. Town Clerk (deposit £1 1s.).

Bootle.—April 4th. Watch Committee. Sodium electric lighting for Southport Road. (See this issue.)

Brightlingsea.—March 16th. U.D.C. One 70-g.p.m. vertical spindle sewage pump, together with electric motor, automatic starter and float gear. Clerk to the Council, Town Hall.

Bristol.—March 15th. Electricity Department. Meter-testing apparatus. (March 4th.)

Chelmsford.—March 22nd. County Public Health and Housing Committee. Electrical installation at Broomfield Court Sanatorium. (February 25th.)

Chesterfield.—March 17th. Electricity Department. E.h.v., cable, one 500-kVA outdoor type kiosk, complete with transformer and switchgear, and one 500-kVA outdoor type transformer. (March 4th.)

Crosby.—March 14th. Borough Council. Stores, including electric lamps, for twelve months. Town Clerk, Town Hall, Waterloo, Liverpool, 22.

Croydon.—March 18th. Electricity Department. One cooling tower, culvert, circulating water piping, valves, &c. (February 25th.)

Darlington.—March 23rd. Corporation. 6,000-V to 400-V transformers. (See this issue.)

Dartford.—March 26th. Corporation. Meter racks. (February 25th.)

Dumfriesshire.—March 21st. County Council. Electrical work at police buildings in English Street. County Clerk.

Dumfries.—March 24th. Electricity Department. Two four-panel h.v. metal-clad switchboards. (See this issue.)

Dundee.—March 16th. Electricity Department. Tower wagon. (February 25th.)

March 16th. L.v. cable. (March 4th.)

Ealing.—March 14th. Electricity Department. Electrical wiring at the Modern School, Cranmer Avenue, West Ealing. Electrical engineer and manager, Electricity House.

Edinburgh.—March 17th. Electricity department. Electrical materials for one year. (March 4th.)

Egypt.—CAIRO.—April 2nd. Ministry of Public Works. Electrical and pumping plant, travelling cranes, lorries, cables, &c., for Mecca water and power scheme. (T.Y. 18398/38.)*

Farnworth.—March 24th. Electricity Department. One 500-kVA transformer. (See this issue.)

Fife.—March 15th. County Council. Electric lighting in police station and house at Comrie. G. Sandilands, county master of works, Kirkcaldy (deposit £1 1s.).

March 28th. Electric lighting installations in twenty houses at Freuchie. County Clerk, Cupar (deposit £1 1s.).

March 21st. Electric lighting at Methil Hill housing estate (108 houses). County Clerk, Cupar (deposit £1 1s.).

Glasgow.—March 14th. Corporation. Electrical installation at Brackenhirst Farm, Airdrie. Town Clerk.

Guildford.—March 14th. Housing Committee. Electrical installations for 146 houses and bungalows. (February 25th.)

Halifax.—March 18th. Education Committee. Electrical work in connection with the alterations to Heath Grammar School. Town Clerk, Town Hall (deposit £1 1s.).

Hemsworth.—March 14th. R.D.C. Electric lighting installations in twenty-seven houses on the rehousing estate at Thorpe Audlin. Clerk of the Council, District Council Offices, Cross Hill (deposit £2 2s.).

Hendon.—March 14th. Corporation. Electrical installation at Woodside Park Junior and Infants' School. (February 25th.)

Horsham.—March 26th. Electricity Department. Meter-testing equipment and three 300-kVA, three-phase, oil-cooled transformers. (See this issue.)

Hull.—March 15th. Electricity Department. Underground cables. (March 4th.)

Keighley.—March 14th. Electricity Department. Transformers, p.i. and r.i. cables, motors and starters, and metal-clad switchgear for twelve months. Town Clerk, Town Hall.

Kilmarnock.—March 21st. Town Council. Electric lamps for all Corporation departments. Town Clerk.

Heating and electrical installations at new public baths. T. C. Stewart, surveyor, Clydesdale Bank Chambers.

Leeds.—March 14th. Corporation. Electrical installation in Nurses' Home extensions at St. James' Hospital. Town Clerk, Room 57, Civic Hall (deposit £2 2s.).

Liverpool.—March 18th. Electric Supply Department. Re plating of a 744-Ah control battery. (February 25th.)

London.—HACKNEY.—March 23rd. Electricity Department. Conductors for the e.h.v. feeder and l.v. distribution systems for one year. (March 4th.)

Lowestoft.—March 24th. Electricity Department. Cable and three indoor type transformers. (See this issue.)

Manchester.—March 25th. Electricity Committee. Cables and service cut-outs for twelve months. (See this issue.)

March 19th. 6.6-kV, three-phase, a.c. switchgear for Dickinson Street "B" sub-station. (See this issue.)

Middlesex.—March 21st. County Council. Electric lighting and power installations for Enfield House Casual Wards. (February 25th.)

March 25th. Electrical installations for proposed new county offices, Uxbridge. (February 25th.)

Milford Haven.—March 21st. Electricity Department. Materials for twelve months. (See this issue.)

Neath.—March 14th. Electrical Engineer's Department. Electrical overhead line service material, a.c. and d.c. meters and electric lamps for twelve months. Clerk to the Council.

Newcastle-on-Tyne.—City Council. Electrical installations in 299 houses and thirty-four bungalows on the Blakelaw estate.

Newton-in-Makerfield (LANCS).—March 21st. Electricity Department. 11-kV isolators and kiosks. (March 4th.)

New Zealand.—WELLINGTON.—April 29th. Posts and Telegraph Department. P.i. telephone cable. (T. 18304/38.)*

April 28th. One automatic voltage regulator. (T.Y. 18120/38.)*

May 4th. Telephone cable. (T.Y. 18645/38.)*

April 20th. 100 batteries. (T. 18643/38.)*

Prestwick (AYRSHIRE).—March 14th. Town Council. Electric lighting installations in 40 houses. Alex. Mair, architect, 20, Wellington Square, Ayr.

Reigate.—March 14th. Electricity Department. Meter-testing equipment. (February 25th.)

South Africa.—PRETORIA.—April 7th. Union Tender and Supplies Board. Single channel carrier system. (T.Y. 18298/38.)*

March 31st. One 80-kVA hydro-electric plant, for Soskop Irrigation Works, Transvaal. (T. 18412/38.)*

March 31st. Public Works Department. Two vertical discharge centrifugal sewage pumps and two high starting torque squirrel-cage motors. (T.Y. 18737/38.)*

March 31st. Thirty-four electric synchronous clocks. (T.Y. 18736/38.)*

CAPE TOWN.—March 31st. Electricity Department. Insulated copper wire. (T. 18397/38.)*

March 29th. 15,000 50-A pole fuses, with accessories, and 500 50-A and 1,000 25-A d.p. ironclad service cut-outs.

March 30th. Overhead line material. (T. 18285/38.)*

March 23rd. Electricity Supply Commission. Insulators. (T. 18450/38.)* 26,440 lb. of hand drawn copper wire. (T. 18400/38.)* Electric light poles, pole fittings and six miles of galvanised steel stay wire. (T.Y. 18401/38.)*

JOHANNESBURG.—March 28th. Railways and Harbours Administration. Train lighting dynamos, auto cut-in switches, lamp resistances, and battery change-over switches. (T.Y. 18293/38.)*

March 30th. 2,000 25-A and 100 50-A, single-pole miniature circuit-breakers. (T. 18796/38.)*

Stockport.—March 14th. Electricity Department. Stores for twelve months. (March 4th.)

Swindon.—March 31st. Great Western Railway. Insulated v.i.r. cables, telegraph ironwork and lamps. (See this issue.)

Tredegar.—March 17th. U.D.C. Requirements for twelve months for the Electricity, Gas and Water and Surveyor's Departments. (March 4th.)

Wakefield.—March 21st. R.D.C. Electric wiring, &c., for forty-eight houses. Clerk of the Council, Council Offices, 18, St. John's North.

Wetherby.—March 17th. R.D.C. Pumping plant consisting of single-phase electric motor and centrifugal borehole pump, for proposed pumping station, near Long Marston, Yorkshire. Clerk to the Council, Council Offices (deposit £1 1s.).

Whitby.—March 22nd. Electricity Department. 5,000 yd. of 6,600-V, p.i. lead-covered, wire armoured cables. (March 4th.)

Workington.—March 21st. Electricity Supply Department. Stores and materials for one year. (March 4th.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Birmingham.—Electricity Committee. Accepted. Electrical installation at Aldridge Road Council School, Perry Barr (£2,276).—H. Pratt, Ltd.

Blackpool.—General Purposes Committee. Accepted. Electrical installation at municipal offices and shops.—T. Dryden & Sons.

Bradford.—Health Committee. Accepted. Electrical installation at Nurses' Home, St. Luke's Hospital (£234).—Smith & Croft.

Electricity Committee. Accepted. Control batteries.—Chloride Electrical Storage Co.; Tudor Accumulator Co. Dual control gear for Valley Road power station.—English Electric Co. Earthing switches.—A. Reyrolle & Co.

Eastbourne.—Electricity Committee. Recommended for twelve months. Small v.i.r. cable.—General Cable Mfg. Co. Transformers.—Hackbridge Electric Construction Co.; British Electric Transformer Co. Cut-outs.—W. Lucy & Co. Street lamp standards.—Bromford Tube Co.; Revo Electric Co. Cookers.—Jackson Electric Stove Co.; G.E.C. Hard drawn copper, &c.—G.E.C.

The borough electrical engineer informs us that the contract for 2-kV and l.v. cables mentioned in our last issue was given to the Telegraph Construction and Maintenance Co., Ltd. Only the 11-kV portion was placed with Standard Telephones & Cables, Ltd.

Finchley.—Electricity Committee. Recommended. Transformers for twelve months.—Bruce Peebles & Co.

Glasgow.—Electricity Committee. Recommended. Transformers.—Bruce Peebles & Co. (£6,320); British Electric Transformer Co. (£1,805).

Transport Committee. Accepted. Magnet coils.—Met.-Vick. Electrical Co. Copper bonds.—B.I. Cables.

Police Committee. Accepted. Electric service lift in the recruits' training centre (£174).—A. & P. Steven. Electric clocks for marine police office (£35).—British Electrical & Mfg. Co.

Liverpool.—Corporation Hospitals Committee. Accepted. Supplies of electrical requirements.—G.E.C.; L. Andrew & Co.; Hirst, Ibbetson & Taylor; Falk, Stadelmann & Co.; Downes & Davies; Howitt (Wholesale); Winstanley & Lambert; Baxendale & Co.; India Rubber, Gutta Percha and Telegraph Works Co.; Lind & Co.; Smith & Cookson; G. P. Dennis; B.I. Cables; Walkers, Parker & Co.; Mersey Cable Works.

Lanark.—County Council. Accepted. Electric lighting at new R.C. School at Tannochside (£337).—Small and McDonald.

London.—L.C.C.—Wiring and fittings for electric lighting, &c., for dwellings on Pembury Road site, Hackney:

	£		£
Holliday & Son (Electrical). Accepted	**2,565**	Atozed (London)	2,792
City Electrical Co.	2,694	F. H. Wheeler & Co.	2,792
Coleby & Co.	2,700	H. J. Cash & Co.	2,804
Jacob, White & Co.	2,772	Pinching and Walton	3,066
W. J. Furse & Co.	2,792	Electrical Installations	3,180
		Houchin	4,175

Wiring and fittings for electric lighting, &c., for dwellings in the Morning Lane area, Hackney:

	£		£
Coleby & Co. Accepted ...	**1,712**	Pinching and Walton	1,991
Houchin	1,759	Buchanan and Curwen	2,002
Archibald Meckhonik	1,847	Francis Polden & Co.	2,024
Read and Partners	1,908	F. G. Edey & Co.	2,024
Samuel Reed & Sons	1,956	Hackney Electricity Department	2,687

Portsmouth.—Contracts Committee. Accepted. 600 lamp column extensions (£417).—Revo Electric Co.

South Shields.—Town Council. Accepted. Electrical installations in 652 houses at Horsley Hill (£3,996).—Ramsay & Co.

Accepted. Cable for the Dean Road sub-station (£450).—B.I. Cables.

Wakefield.—Housing Committee. Accepted. Wiring 170 houses on the Peacock Farm estate.—H. Goodyear.

York.—Assistance Committee. Recommended. Internal telephone installation at the Institution (£236).—John Stubbs Industries.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, March 17th. Institution, London, W.C.2. 6 p.m. "Recent Progress in Power Rectifiers and their Applications." Mr. W. G. Thompson. Monday, March 14th. 7 p.m. Informal meeting. Discussion on "High Tension Direct Current." To be opened by Messrs. W. E. Highfield and J. E. Calverley.

Meter and Instrument Section.—Friday, March 18th. Institution, London, W.C.2. 7 p.m. Informal discussions on "Meter Practice in Paris" (to be opened by Mr. A. M. Strickland) and "The Future of Meter Testing."

Western Centre.—Monday, March 14th. South Wales Institute of Engineers, Cardiff. "Switchgear Developments." Mr. W. E. J. Farvis.

North-Eastern Centre.—Monday, March 14th. King's College, Newcastle-on-Tyne. 6.15 p.m. "High Speed Protection as an Aid to Maintaining Electric Service." Messrs. T. W. Ross and C. Ryder.

Wednesday, March 16th. Literary and Philosophical Society, Westgate Road. 7 p.m. Faraday Lecture on "The Evolution of Electrical Power." Dr. A. P. M. Fleming.

North-Western Centre.—Tuesday, March 15th. Engineers' Club, Manchester. 7.15 p.m. Joint meeting with the Institution of Post Office Electrical Engineers. "Properties and Testing of Dielectric Materials." Messrs. J. F. Doust and W. J. Sulston.

North Midland Centre.—Tuesday, March 15th. Hotel Metropole, Leeds. 7 p.m. Informal discussion, "Public and Private Supply."

Northern Ireland Sub-Centre.—Tuesday, March 15th. 9, Wellington Place, Belfast. 6.30 p.m. "The Moving-coil Voltage Regulator." Mr. E. D. T. Norris.

Sheffield Sub-Centre.—Wednesday, March 16th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Modern Factors Affecting Electricity Costs and Charges." Mr. J. A. Sumner.

Physical Society.—Friday, March 11th. Imperial College of Science and Technology, South Kensington, S.W.7. 4.45 for 5.15 p.m. Annual general meeting and short papers.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, March 12th. South Wales Institute of Engineers, Cardiff. 6 p.m. Lecture on "Modern Transformer Practice." Mr. R. M. Charley.

Thursday, March 17th. Visit to the G.E.C. lamp works, Hammersmith.

Illuminating Engineering Society.—Tuesday, March 15th. Trocadero Restaurant, Piccadilly, London, W.1. 6.45 for 7.30 p.m. Annual dinner and dance.

Association of Supervising Electrical Engineers.—Tuesday, March 15th. 2, Savoy Hill, London, W.C.2. 7.15 p.m. Lecture on "Electricity Distribution in Large Buildings." Mr. J. Stinton Jones.

Institution of Civil Engineers.—Tuesday, March 15th. Grosvenor House, Park Lane, London, W.1. 7.15 for 7.45 p.m. Annual dinner.

Electrical Wholesalers' Federation.—Thursday, March 17th. Savoy Hotel, London, W.C.2. 6.30 for 7 p.m. Annual dinner.

British Electrical Development Association.—Friday, March 18th. Savoy Hotel, London, W.C.2. 12.45 for 1 p.m. Annual luncheon.

Central England Area.—Tuesday, March 15th. Birmingham. Annual general meeting and luncheon.

Batti-Wallahs' Society.—Friday, March 18th. Grosvenor House, Park Lane, London. Annual dinner and dance.

Notes

The Birmingham Electric Club

Praise to Birmingham for the way in which it was dealing with the legacy of conditions bequeathed to it by the Victorian era was given by Mr. J. M. Kennedy, deputy chairman of the Electricity Commission, last Friday when proposing the toast of "The City of Birmingham" at the twenty-seventh annual dinner of the Birmingham Electric Club at the Grand Hotel. They must remember, he said, that a very large proportion of the population still lived in industrial areas. They wanted them to have clean air and Birmingham had taken the lead in initiating one of the largest and first power stations having grit-extraction installations. The city had advanced very rapidly electrically and in the past eight years the consumption per head of population had increased from 326 to 600 kWh, the average consumption for the whole of the country being only 380 kWh. Although Birmingham was well in advance of the rest of the country, there was no reason to be complacent and no saturation point was in sight. This was not only true in Birmingham but in the rest of the country as well. Whatever form the proposed reforms in distribution might take he believed that there would be ample work for all. Replying, the Lord Mayor of Birmingham, Councillor E. R. Canning, asked the electrical industry for a standard of wiring and also for cheaper electricity for country villages. Proposing the toast of "The Birmingham Electric Club," Mr. H. J. Manzoni, city engineer and surveyor, said that electricity was the best method so far discovered of releasing energy from matter. Ultimately, he imagined, it would be produced in some easier fashion on their own premises. Mr. F. S. Ette, president of the Club, in response, declared that it was through the energies of the younger members that the club would progress. Other speakers were Mr. S. Hamilton, Dr. D. S. Anderson and Mr. H. Hooper.

North Midland I.E.E. Annual Dinner

The annual dinner of the North Midland Centre of the Institution of Electrical Engineers was held on March 4th at the Hotel Metropole, Leeds. Mr. J. G. Craven, chairman, was unable to be present owing to indisposition, so the vice-chairman (Mr. J. W. Atkinson) read Mr. Craven's intended speech on his behalf. It referred to the success of the Post Office scheme of cheap evening telephone trunk calls and suggested that a moral could be drawn from it in relation to other forms of business as a revenue-earning enterprise at quite small proportionate increase in overhead expenses. Sir George Lee, President of the Institution, replying to the toast of the Institution, said that with all the labour-saving devices produced in the past fifty years in industry we were faced now with two possibilities—shorter working hours, or the alternative of employing more people in the production of what might be called "luxuries." The "luxury" of the future was further development of electrical usages, and he would like to see the energies of all electrical engineers concntrated upon that as the industry's contribution to the social welfare of the future. The amount of money spent on research in the electrical industry was still ridiculously small. There was need for new development in methods of storing electricity. He was not satisfied that the ordinary accumulator was at all "the last word" possible on this matter. In the course of his speech Sir George referred to carrier telephone developments. Other speakers were Professor E. L. E. Wheatcroft (past-chairman of the North Midland Centre), Mr. Frank Parkinson, and the Lord Mayor of Leeds (Ald. J. Badlay).

I.M.E.A. (North-East England Centre)

The annual meeting of the North-East England Centre of the I.M.E.A. was held on March 2nd at West Hartlepool, there being an excellent attendance of engineers and local authority representatives. This was followed by a luncheon at the Grand Hotel at the invitation of the West Hartlepool Elec-

tricity Committee. Mr. W. A. Royle, borough electrical engineer of Sunderland, occupied the chair, and Mr. W. J. Bache, the president of the Association, gave an account of the activities of the Council. The officers elected for the ensuing year were as follows:—Chairman: Mr. W. A. Royle; vice-chairman: Councillor V. Richards, Annfield Plain; hon. secretary and treasurer: Mr. S. Tillotson, borough electrical engineer, West Hartlepool.

The E.I.B.A.

The Electrical Industries Benevolent Association is holding its annual general meeting on April 8th at the Savoy Hotel, London, W.C.2. Mr. Frank Parkinson will pass on the office of president to Mr. E. E. Sharp, whose position as chairman of the Court will be taken by Mr. J. N. Stephens, who for many years has been chairman of the Relief Committee. The meeting will be followed by the annual luncheon. Tickets for this function (10s. each) can be obtained from the secretary, 6, Southampton Street, Holborn, W.C.1.

The Tees-side branch held its annual ball on February 25th. All the tickets were sold and the supper was served in two relays owing to the large number present. The event reflects greatly to the credit of the branch, of which the president is Ald. S. A. Sadler (chairman of the Middlesbrough Corporation Electricity Committee), and the chairman, Mr. H. Sanderson (a partner in A. Jones & Co., electrical wholesalers). Among those present were the Mayors and Mayoresses of Middlesbrough, Darlington, West Hartlepool, Redcar and Thornaby and the electrical people, many of whom had come from long distances, included Messrs. E. J. Edgar (C.E.B.), C. H. Stagg (engineer, Eston U.D.C.), R. L. Hewling (engineer, Skelton U.D.C.), and representatives of electrical firms, including the local managers of British Insulated Cables, Ltd., British Thomson-Houston Co., Ltd., General Electric Co., Ltd., and Electrical Components, Ltd. The secretary of the branch is Mr. H. Haigh (borough electrical engineer of Middlesbrough).

E.A.W. Activities

At the 1937 annual conference the special session "A Discussion on Kitchen Planning," led to a kitchen planning competition being organised for a money prize offered by Margaret, Lady Moir. Most of the eighty branches took part in the competition, entrants having to show, by means of a plan, how they would alter and replan the kitchen to eliminate unnecessary lifting, carrying and walking; and to improve storage and preparation spaces and generally reduce waste of time and undue fatigue in everyday activities. The prize is being divided between Mrs. Bennion-Stant (Gresford) and Mrs. Lawton (Sutton Coldfield).

The Minister of Transport, the Rt. Hon. E. Leslie Burgin, M.P., is to be the chief guest at the luncheon to be held at the Park Lane Hotel on Thursday, April 29th, in connection with the annual conference.

At the forthcoming Glasgow Empire Exhibition, the Association is organising a conference under the title of "The New Way of Living, Women's Work in the Modern World," which will be held from June 18th to 21st.

"Black-out" Demonstration at Lichfield

Over 300 technical experts from all over the country attended a demonstration at Lichfield last Tuesday showing how a town can be "blacked-out" within thirty seconds in case of air raids. Explaining the method of control, Mr. W. F. Russell, who was largely responsible for its development in its initial stages, said that a positive d.c. impulse applied to the network for approximately two seconds switched the lamps on and a negative impulse switched them off. For other services each receiver was arranged to receive only the particular signal intended for it, the polarity in this instance being immaterial. To produce the signal an electrically operated change-over contactor was so connected that momentarily a resistance of 0.1 ohm was inserted between the neutral and the centre point of the transformer, a 6-V battery being connected across the resistance. The effect was to give a slight bias to the wave, either positive or negative according to the signal being sent. In each sub-station there was a biasing panel controlled over pilot wires or telephone wires from a master controller. Besides its use in case of air raids the system provided central control of street lighting and off-peak loads, as well as a calling system for a volunteer fire brigade. Altogether fourteen different operations could be controlled by the system, but only ten were being used at present. If the system should be damaged, control could be decentralised and the signals sent out manually from each sub-station. The designers and manufacturers of the equipment were Standard Telephones & Cables, Ltd. The sirens installed, supplied for the demonstration by Chalk and Harris, were worked by compressed air controlled by magnetic valves made by the Magnetic Valve Co., Ltd.

On Wednesday last a concrete mixer at Battersea power station cut through a cable, causing the death of one man and injury to six others.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

EMERSON NORTH WIND air-conditioning plant (British Agents).

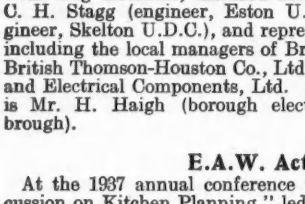
Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Sir George Simpson, K.C.B., C.B.E., F.R.S., director of the Meteorological Office of the Air Ministry, is to retire in September next.

Mr. W. J. Dawson, of Hazel Grove, has been appointed commercial assistant with the Scarborough Corporation Electricity Department at a salary of £375 per annum.



Mr. V. A. Pask, city electrical engineer of Norwich, whose undertaking has recently completed the extensions described in this issue

In addition to the increases in salaries of the staff of the Croydon Corporation Electricity Department, recorded in our last issue, the following have been granted: Mr. R. A. Jackson, mains assistant, from £246 to £279; Mr. W. Gadsby, mains assistant, from £234 to £246; and Messrs. G. Holland and W. H. Green, junior mains assistants, from £218 to £234.

Mr. J. W. Atkinson, of the G.P.O., Leeds, has been nominated for the chairmanship of the North Midland Centre of the Institution of Electrical Engineers for the 1938-39 session.

Mr. R. Cocks, electrical engineer at the Dock for Boston Corporation, was recently married to Miss Doris M. Reynolds, Boston.

Mr. C. W. Salt, city electrical engineer, Carlisle, was elected chairman of the Northern Counties Area of the British Electrical Development Association at the annual meeting held on March 3rd. **Mr. S. I. Ellis,** lighting engineer with the North Eastern Electric Supply Co., Ltd., was elected vice-chairman, and **Mr. S. Tillotson,** borough electrical engineer, West Hartlepool was appointed to represent the Area on the National Council.

Mr. F. A. Orchard, M.I.E.E., has been nominated as chairman of the North-Eastern Centre of the Institution of Electrical Engineers for the 1938-39 session.

Mr. W. J. Cooper, electrical engineer to the Hamilton Corporation, has been nominated for the chairmanship of the Scottish Centre of the Institution of Electrical Engineers for the 1938-39 session.

Mr. C. Day, chairman of Mirrlees, Bickerton & Day, has joined the board of Petters, Ltd.

Mr. P. Bregazzi, A.M.I.E.E., assistant borough electrical engineer of Douglas, has been presented with a gold watch by the staff of the Electricity Department on leaving the Isle of Man to take up the position of electrical engineer and manager at Ashton-under-Lyne.

Dr. L. F. E. Johnson, an authority on hot-cathode rectifier equipments, has joined the technical staff of London Transformer Products, Ltd., Willesden, to collaborate in the design and manufacture of this type of equipment. Dr. Johnson was previously engaged in the manufacture of similar equipment with the British Radio Corporation, Ltd.

Obituary

Mr. E. H. M. Eldridge.—We regret to announce the death of Mr. E. H. M. Eldridge, Ipswich branch manager of Johnson & Phillips, Ltd., which occurred at his home on March 2nd. Mr. Eldridge was an old British Westinghouse apprentice; he spent a number of years in the Switchgear Department at Trafford Park and later went to Park Royal. He was particularly interested in electric water heating.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

B.C. & H. Power Station Co., Ltd.—Public company. Registered February 26th. Nominal capital of £100. Objects: To enter into agreements and leases with the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., and the Central Electricity Board in connection with the proposed generating station at Little Barford, Beds, and any extension thereof, and to generate and supply electricity, &c. The subscribers are: E. Sanders and S. G. Brown, both of 2, Bond Court, Walbrook, E.C.4, and five other clerks. The directors' borrowing powers are restricted to an amount not exceeding £2,500,000. Registered office: Thames House, Millbank, S.W.1.

English Electric Export & Trading Co., Ltd.—Private company. Registered March 2nd. Nominal capital, £10,000. Objects: To carry on the business of manufacturers and exporters of and dealers in electrical plant and machinery, dynamos and electrical apparatus and appliances, &c. The subscribers are: J. H. Pharo, 17, Newlands Court, Streatham Common Road, S.W.16, and J. E. Williams, 78, Rosemary Avenue, Finchley, N.3. Solicitors: Linklaters & Paines, 2, Bond Court, Walbrook, E.C.4.

Gayne & Co., Ltd.—Private company. Registered February 26th. Capital, £1,000. Objects: To acquire the business of a radio and electrical dealer and engineer carried on by R. J. Towers at 487, Bromley Road, Downham, and 646, Downham Way, Bromley, as Gayne & Co. The permanent directors are: R. J. Towers (managing director), and Mrs. K. A. Towers, both of 20, Elmfield Road, Bromley. Registered office: 487, Bromley Road, Downham, Bromley, Kent.

J. F. Hales & Sons, Ltd.—Private company. Registered March 2nd. Capital, £1,000. Objects: To carry on the business of electrical engineers, &c. The subscribers are: V. C. Yeldren, 26, Tivoli Road, West Norwood, S.E.27, and Mrs. I. K. Underwood, 29, The Woodlands, Beulah Hill, S.E.19. Registered office: 56, Moorgate, E.C.2.

Totalfinance, Ltd.—Private company. Registered March 2nd. Capital, £10,000. Objects: To carry on the business of mechanical and electrical engineers, dealers in all kinds of electrical appliances, &c. The first and permanent directors are A. C. Maxwell and C. D. Strickland. Solicitors: Travers Smith, Braithwaite & Co., 4, Throgmorton Avenue, E.C.2.

A. C. Cash, Ltd.—Private company. Registered February 28th. Capital, £2,000. Objects: To carry on the business of electricians, mechanical engineers, and manufacturers, and workers of and dealers in electricity, motive power and light, radio apparatus and accessories, &c. The directors are: G. H. Bastin, Wallington, All Saints Road, Cheltenham, P. P. Davis, Inglecroft, Cleeve Hill, nr. Cheltenham, and A. C. Cash, 10, Barton Road, Tewkesbury, electrician. Registered office: 24, High Street, Tewkesbury.

Brighton Battery Co., Ltd.—Private company. Registered March 2nd. Capital, £1,000. Objects: To carry on the business of manufacturers of and dealers in electric batteries, accumulators, cells, plates, acids and chemicals, &c. The subscribers are: A. J. P. M. Francis-Hawkins, "Pimpernel," Keymer Avenue, Peacehaven, Sussex, and H. C. Galloway, 1, East Street, Brighton. H. C. Galloway is permanent director.

Thermo Constructions (Wembley), Ltd.—Private company. Registered February 28th. Capital, £2,000. Objects: To carry on the business of mechanical and electrical engineers, manufacturers of heating and cooling apparatus of all types, steam, water and electrical fittings, steam specialities and pumps, &c. The directors are: J. A. Eijssen and D. J. Eijssen, both of 111, Cassiobury Drive, Watford.

McKinlay Electrical Manufacturing Co., Ltd.—Private company. Registered March 3rd. Capital, £2,000. Objects: To carry on the business of manufacturers, exporters and importers and licensees of, agents for and dealers in intercommunication telephone apparatus, radio sets and apparatus; manufacturers, exporters and importers of and dealers in cinematographic and photographic apparatus, &c. The subscribers are: F. H. Rover, 12, Claremont Gardens, Upminster, Essex, and A. Evans, 27, Tanza Road, Hampstead, N.W.3. Solicitors: Richards Butler Stokes & Woodham Smith, 88, Leadenhall Street, E.C.3.

Light Work (Domestic), Ltd.—Private company. Registered February 26th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in vacuum cleaners, electric fires, radiators, lamps, cookers and irons, &c. The subscribers are: C. H. W. Taylor, 143, Harold Road, Ilford, and Wm. G. Jackson, 1, Lincoln Road, E.7.

F. Simpkin & Co. (Leeds), Ltd.—Private company. Registered March 4th. Capital, £1,000. Objects: To acquire the business of electrical engineers and acetylene welders now carried on by G. Simpkin and E. Higgens as administrators of the estate of the late Fdk. Simpkin at 12, Park Cross Street and at Victoria Works, Coventry Street, both in Leeds, as F. Simpkin & Co. The subscribers are: Mrs. G. Simpkin, Joan Royd, Stanks, Leeds; and E. Higgens, West House, Drury Lane, Wakefield. Registered office: 15, Park Cross Street, Leeds.

Battery Supplies (Electrics), Ltd.—Private company. Registered March 4th. Capital, £100. Objects: To acquire the business of a radio and electrical engineer carried on by R. Jackson at 38, Whalley Range, Blackburn, and to carry on the business of manufacturers of and dealers in accumulators, batteries, &c. The directors are: R. Jackson, 114, Lynwood Road, Blackburn; and J. E. Lynch, 133, St. James's Road, Blackburn. Registered office: 38, Whalley Range, Blackburn.

Returns of Electrical Companies

Pickerings, Ltd.—Mortgage on 2 and 3, Station Street, Stockton-on-Tees, dated February 16th, 1938, to secure £1,100. Holders: A. A. Luxmoore and E. Luxmoore, both of Shincliffe, Co. Durham.

Electralave, Ltd.—Particulars filed of £12,000 debentures, authorised February 15th, 1938, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £5,000.

Collins & Scott, Ltd.—Particulars filed of £300 debentures, authorised January 31st, 1938, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Satisfaction to the extent of £300 on January 8th, 1938, of series of debentures authorised by resolution dated March 9th, 1936, and registered March 13th, 1936.

Queensway Radio, Ltd.—Capital, £1,000 in £1 shares. Return dated October 7th, 1937. 860 shares taken up. £860 paid. Mortgages and charges nil.

Grays Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated November 18th, 1937. All shares taken up. £260 paid, £740 considered as paid. Mortgages and charges nil.

H.P. Radio Services, Ltd.—Capital, £100 in £1 shares. Return dated December 1st, 1937. All shares taken up. £100 paid. Mortgages and charges nil.

Electra (Birmingham, 1935), Ltd.—Capital, £500 in £1 shares. Return dated September 21st, 1937. All shares taken up. £500 paid. Mortgages and charges nil.

Power, Light & Heat, Ltd.—Capital, £6,800 in 1,500 preference and 5,300 ordinary shares of £1. Return dated December 14th, 1937. 1,500 preference and 5,285 ordinary shares taken up. £1,502 paid, £5,253 considered as paid, £30 calls unpaid. Mortgages and charges: £700.

British Brown-Boveri, Ltd.—Capital, £50,000 in £5 shares. Return dated November 26th, 1937. All shares taken up. £21,250 paid (£2 10s. per share) on 8,500 shares, £7,500 considered as paid (£5 per share on 1,500 shares). Mortgages and charges nil.

Electric Reduction Co., Ltd.—Capital, £50,000 in 16,200 preference and 33,800 ordinary shares of £1. Return dated December 3rd, 1937. 16,200 preference and 28,800 ordinary shares taken up. £18,000 paid on 13,000 preference and 5,000 ordinary shares, £27,000 considered as paid on 3,200 preference and 23,800 ordinary shares. Mortgages and charges: £25,000.

Edwards & Hope, Ltd.—Capital, £2,000 in £1 shares. Return dated December 13th, 1937. All shares taken up. £1,500 paid, £500 considered as paid. Mortgages and charges nil.

Henderson & Priestley, Ltd.—Capital, £5,000 in £1 shares. Return dated January 13th, 1938. 2,836 shares taken up. £2,836 paid. Mortgages and charges nil.

North-Eastern Electric Supply Co., Ltd.—Satisfaction to the extent of £24,700 on February 8th, 1938, of trust deed dated August 1st, 1935, and registered August 13th, 1935, securing £1,500,000 3½ per cent. consolidated debenture stock.

Boro' New Electric Signs, Ltd.—Mortgage on the company's undertaking and property, present and future, including uncalled capital, dated February 15th, 1938, to secure all moneys due or to become due from the company to the National Provincial Bank, Ltd.

British Electric Domestic Appliances, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 23rd, 1938, to secure £2,500. Holders: Control Nominees, Ltd.

L. C. Rawlence & Co., Ltd.—Particulars filed on March 1st, 1938, of £20,000 debentures, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued, and ranking *pari passu* with existing series.

British Central Electrical Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 21st, 1938, to secure £1,000 (ranking *pari passu* with two existing debentures for £1,000 each). Holders: Branch Nominees, Ltd.

City Notes

The North Metropolitan Electric Power Supply Co. reports a net revenue for 1937 of £904,949 as compared with £855,443 in the preceding year, to which is added £63,666 brought in, making £968,615. From this the following allocations have been made:—Debenture and loan interest, £80,628; reserve for 5 per cent. mortgages, £2,000; debenture redemption, £45,387; depreciation and reserve account, £374,082; and contingency account, £30,000. The balance available is £436,518. A final dividend of 6 per cent. is recommended on the ordinary stock, making 10 per cent. for the year (same) and £74,367 is carried forward. The capital expenditure during the year, mainly upon plant, machinery, buildings, trunks and distributing mains, amounted to £877,620; adding the purchase price of the undertakings of the Harrow Electric Light & Power Co., Ltd., the total capital expenditure during the year was £1,068,828. Approximately 236 miles of underground mains were laid and thirty-one miles of overhead lines were erected during the year. The total length of underground mains and overhead lines at the end of the year, including ninety-one miles transferred from the Harrow Co., was 3,482 miles. New sub-stations put into service numbered eighty-one, making with ten previously belonging to the Harrow Co., a total of 930. The total

number of kWh supplied during the year was 690,800,000, as compared with 597,600,000 in 1936, an increase of 93,200,000 kWh, or 15.6 per cent. The number of consumers supplied either directly or indirectly by the company at December 31st was 375,067, as against 336,722 at the end of 1936. The number of consumers supplied directly by the company, including Harrow consumers, was 253,400 at December 31st, 1937. The system was extended during the year to provide a supply to twenty-two additional villages. During the year 1,723 additional street lamps were put into operation, bringing the total to 13.501. New showrooms were opened at Friern Barnet and Hatfield. Reductions in the rates of charge to large power consumers were introduced as from April 1st, 1937.

The Electrical Distribution of Yorkshire, Ltd., reports a profit for 1937 of £251,476, as against £218,906 for 1936, which with £56,181 brought in makes £307,657. The final dividend on the ordinary stock is 4½ per cent., maintaining the distribution for the year at 9 per cent., £100,000 is placed to depreciation and reserve, and £58,168 is carried forward. Sales of electricity amounted to 54,792,249 kWh (against 48,591,730 kWh), and the number of consumers connected rose from 93,161 to 105,225. Expenditure on works amounted to £316,124, and was incurred in meeting new and additional demands. The subsidiary companies in Cumberland are making satisfactory progress, and at the end of 1937 there were 7,668 consumers supplied from over 370 miles of mains. After making provision for depreciation and reserves these companies have paid dividends for 1936 which are included in the revenue now under review. Meeting: March 14th.

The West Wilts Electric Light & Power Co., Ltd.—The preference shareholders have received a letter from the liquidator of the company stating that Edmundsons Electricity Corporation, Ltd., is offering five 6 per cent. cumulative preference shares of £1 each fully paid in exchange for each £6 nominal of preference shares in the West Wilts Co. It is pointed out that the Western Electricity Supply Co., Ltd. (owned and controlled by Edmundsons) holds 95 per cent. of the ordinary shares and over 87 per cent. of the preference shares in the West Wilts Co. The preference shares now to be issued will rank *pari passu* with the 6 per cent. cumulative preference stock already issued. The liquidator states that the offer is outside the normal scope of the liquidation of the company. In the event of a shareholder not accepting it, his shares will be repaid at par (20s. per share), in accordance with the articles of association.

The Metropolitan Electric Supply Co., Ltd., reports a gross revenue for 1937 of £1,576,893, as compared with £1,455,261 in the preceding year, and a net revenue of £455,507, as against £491,791, to which are added interest and dividends on investments and sundry fees £237,896, and £151,104 brought in, making £844,505. The ordinary dividend for the year is maintained at 10 per cent., by the final payment of 7 per cent., and a bonus of 2 per cent. is also paid on the ordinary shares (against a jubilee bonus of 2½ per cent., tax free), leaving £161,826 to be carried forward. The total capital expenditure during the year in the London and Western areas was £493,424, of which about £400,000 was spent on mains. Meeting: March 15th.

The Llanelly and District Electric Supply Co., Ltd., reports a profit for 1937, including £1,966 brought in, of £84,276, and after appropriating £34,000 to depreciation and general reserves there is a balance of £50,276. It is proposed to pay a dividend on the ordinary shares for the year of 5½ per cent., less tax, and to carry forward £1,976. The report states that the electricity supply business shows further satisfactory improvement. The extensions in the Gwendraeth Valley which were commenced during 1935 have been completed. The operating results of the traction undertakings again show some improvement.

A. C. Cossor, Ltd.—Public subscriptions and applications from firm underwriters were received for over 50 per cent. of both classes of shares offered for sale last week. The *Financial Times* reports that as it is understood that about 20 per cent. of the issue was underwritten firm the result is that underwriters have taken about 70 per cent. of the issue. Applications from the public numbered about 1,000.

Walsall Conduits, Ltd., announces that the preliminary figures for 1937 show the profit to be substantially in excess of that for the previous year. It is proposed to pay a final dividend of 35 per cent. on the ordinary shares, less tax, making 55 per cent., less tax, for the year. For the previous accounting period, November 16th to December 31st, a dividend of 6¼ per cent. was paid, equivalent to a rate of approximately 50 per cent. per annum.

The Mid-Cheshire Electricity Supply Co., Ltd.—The placing has now been completed of a large line of £1 4 per cent. cumulative preference shares. The *Financial Times* reports that in December last the company offered to shareholders 300,000 of these shares at par, of which 86,875 were subscribed. The balance of 213,125 shares has been privately issued in blocks, the last line, now placed, comprising 52,765 shares.

The Midland Electric Manufacturing Co., Ltd., reports a net profit for 1937 of £53,770, as compared with £52,701 in the previous year, after providing for N.D.C. and adding £29,174 brought in. A dividend of 10 per cent. is paid for the year on the ordinary capital plus a bonus of 15 per cent., reserve receives £20,000, and £30,601 is carried forward. An ordinary dividend of 10 per cent. and a bonus of 15 per cent. was paid for 1936, but was distributed on smaller capital. Meeting: March 15th.

The Salisbury Electric Light & Supply Co. has received an offer from the Wessex Electricity Co., of £196,478 for the undertaking of the company. Both companies are subsidiaries of Edmundsons Electricity Corporation. Acceptance of the offer would enable a distribution of 32s. 6d. a share to be made on liquidation of the Salisbury Co. The Salisbury City Council has passed a resolution protesting against the proposed transfer of the undertaking and the resolution is being sent to the Electricity Commissioners. At the annual meeting of the Salisbury Co. on Tuesday last, Mr. C. J. Woodrow (chairman), said that the directors had decided, with the shareholders' approval, to adjourn the question of the purchase of the company by the Wessex Co., and at an extraordinary meeting which followed, he stated that the rights of the City Council were safeguarded and it could purchase the undertaking if they desired in 1940.

The Western Electricity Supply Co., Ltd.—Edmundsons Electricity Corporation, Ltd., is offering five £1 6 per cent. cumulative preference shares for every six of the 79,109 £1 six per cent. cumulative preference shares of the Western Electricity Supply Co. in the hands of the public. A circular issued by Edmundsons states that if any preference holders do not accept the offer and the Western Company goes into liquidation the shares will be repaid at 21s. each. Acceptance of the offer must be notified by March 15th.

The Northampton Electric Light & Power Co., Ltd., held its annual meeting on March 4th when Mr. R. E. Lamb (chairman), who presided, said that there were very few parts of their statutory area where a supply of electricity could not now be obtained, and such gaps as there were—none of them of a remunerative nature—were rapidly being filled up. During the year they added 3,750 new consumers, bringing the total to well over 46,000. The total output from the Hardingstone station was 140¼ million kWh, as compared with 116 million kWh in 1936, an increase of 21 per cent. All this was taken by the Central Electricity Board, from whom they bought back 94 million kWh. The actual sales to their own consumers and their associated companies were 10 million kWh higher than in the previous year, the total being 85¼ million kWh. The rate of increase showed no signs of slackening at present. To meet the increasing demand for export of electricity to the Central Board they were about to proceed with the installation of another 30,000-kW unit, which was expected to be ready for operation in the autumn of 1940. The long period required for construction was due to the present busy state of the manufacturers' factories. The extension would involve the spending of a large sum of money, but it was not anticipated that any fresh issue of capital would be required for this purpose during the current year. Some of their district offices were inadequate, and new or enlarged offices were about to be provided in several urban areas, notably at Wolverton and Bletchley.

The Hendon Electric Supply Co., Ltd., reports a total income for 1937 of £313,189, as compared with £291,668 in 1936, and a net working profit of £87,928 (against £87,294). Repairs and renewals reserve receives £25,000, general reserve £843, and tax account £12,000. The final ordinary dividend is 5¼ per cent., tax free, making 7⅞ per cent., tax free, for the year (same) and £17,298 is carried forward. The sales of electricity during the year amounted to 49,739,710 kWh, as against 45,232,673 kWh in 1936. Meeting: March 14th.

The Midland Counties Electric Supply Co., Ltd.—Presiding at the annual meeting held on March 7th, Mr. G. Balfour (chairman), in referring to the transport business, said that, including the newly acquired Mansfield undertaking, they now operated 277 vehicles, of which 244 were Diesel or petrol-driven and thirty-three were trolley-buses. They carried last year about 50 million passengers. The electricity supply undertakings continued to record an increase in the maximum load and kWh output. They had for years past pursued a regular policy of unification and of reductions in tariffs, and had been able to reduce prices, due to an intensive cultivation of business. The generating plant now installed and operating in their three power stations had a total capacity of 150,000 kW. They inaugurated supplies in an additional fifty-one parishes during the year, bringing the total districts supplied, including the Tamworth undertaking, up to four boroughs, thirty-one urban districts, and 634 parishes. In addition, they entered into contracts for public lighting in one urban district and eleven rural parishes. Their public lighting services, including Tamworth, now covered three boroughs, seventeen urban districts and 141 rural parishes. During the year they added to the distributing system 258 miles of h.v. lines and 323 miles of l.v. lines, bringing the total up to 1,774 miles of h.v. and 2,069 miles l.v. lines. They now had in operation 1,325 sub-stations. They connected additional load amounting to 43,587 kW, to which must be added 22,599 kW, the connected load of the Tamworth undertaking, making the total at the end of the year 352,528 kW. The total maximum load on their generating stations was 124,420 kW, of which 8,000 kW was for the Central Electricity Board. At the end of the year they had 134,102 consumers connected to the system, an increase, including 10,307 from Tamworth, of 25,836 over the previous year. Sales showed a substantial increase, the total for the year being 419 million kWh. If the kWh supplied under large bulk and special commercial contracts and sales of the Tamworth Co. were excluded, they had a figure of 306 million kWh as compared with 262 million kWh for the previous year, an increase of over 16 per cent. The average price obtained over the whole area was 0.840d. per kWh, which was very low—bearing in mind that the consumers were scattered over 2,391 sq. miles of territory. Last year they made reductions in charges in certain areas, and all their tariffs, except for newly acquired Tamworth, were on the same basis. They were keeping an eye upon the question of charges, and they might possibly make further reductions during the current year.

The Lancashire Electric Light & Power Co., Ltd., held its annual meeting on March 3rd when Mr. G. Balfour (chairman), who presided, said that during the past four years the maximum load had inceased by approximately 40 per cent., the receipts by 36 per cent., and the balance on trading by about 45 per cent. During the year they expended over £670,000 on capital account, of which £450,000 was on the Kearsley power station, but £64,000 was written off the Radcliffe station machinery, making the net expenditure on generating stations approximately £388,000. The total spent on mains and the distribution system was £282,000, of which £106,000 was incurred in their Provisional Order areas, mostly on domestic services. During the year they provided ninety-three miles of l.v. distribution and forty-nine miles of h.v. distribution, a total of 142 miles. These extensions brought the total of l.v. mains, cables and transmission lines up to 1,079 miles and h.v. mains to 833 miles. The 50,000-kW set installed at Kearsley improved the efficiency of the plant as a whole and the erection

of the second set was proceeding and it should be ready for initial trials in July next. During the year a maximum combined load of 166,137 kW was recorded by the Kearsley, Radcliffe and Padiham stations. The total energy sold amounted to 791 million kWh, of which 449 million kWh was sold to their own customers, as compared with 370 million kWh in the previous year. The amount taken by the Central Electricity Board was nearly 342 million kWh, as compared with 184 million kWh in 1936. They connected 5,922 additional domestic consumers during the year, making a total of 45,420, an increase of 13 per cent. on the previous year. The total number of consumers supplied directly and the consumers of other undertakings which they supplied in bulk was approximately 143,000, an increase of 10.6 per cent. on the previous year's figure. They were steadily increasing the number of their consumers who adopted the two-part tariff and of the total number of l.v. consumers connected 86 per cent. had adopted this tariff. Reductions in the price of electricity to consumers were made in July, 1936, and therefore only affected the latter half of that year, whereas they applied to the whole of last year. These reductions were reflected in the drop in the average price received by the company from this class of business from 2.06d. per kWh in 1935 to 1.92d. per kWh in 1936, and 1.81d. last year. The kWh per consumer, however, increased by approximately 2½ per cent. Excluding the supply taken by the Central Board the average price per kWh sold overall was 0.564d. per kWh, as compared with the previous year's figure of 0.604d. per kWh. The electricity demand for power and domestic use in any area was a fairly stable indication of trade prosperity, and based on this assumption the outlook was very satisfactory. Last year each month showed an increase compared with 1936, and it was pleasing to know that they had started the current year with a comfortable increase over last year. There had been a great deal of talk about trade decline, but they supplied a large number of consumers in the textile trade, spinners and weavers, iron, coal, and steel industries, bleachers and dyers, miscellaneous engineering works, and railway load, as well as electro-chemical processes, and, judging by the demand of those industries upon their services, they could see no change for the worse in the near future.

Hall Telephone Accessories (1928), Ltd.—Presiding at the annual meeting held on March 3rd Major the Hon. O. M. Guest (chairman) said that the policy of increasing their resources by the issue of 161,280 shares of 10s. to shareholders in July at 11s. per share was justifying itself, and the practical results from a shareholder's point of view should be more evident in 1938. A dividend equalisation reserve account had been created by an allocation of £10,000 and by the use of this reserve they hoped to iron out any avoidable fluctuations in dividends in the future. Their Government work, which was earmarked for Dowlais, had been held up by the non-completion of the building, but the new factory was now in production. In their main factory at Willesden all their 1937 extensions to buildings and additions to plant and machinery had been fully used. Their Post Office contracts had remained satisfactory and they had received further orders from this source. Their work for private customers had increased in 1937. In their work for Government departments other than the G.P.O. they had tried to confine themselves to an expansion within their past scope and experience, namely, in technical instrument making and precision work. Such precision work was exceptionally in demand just now, but such products had a reasonably steady demand in normal times. Their order book was at present larger than ever before in their history, and he saw no signs of diminution in their activities.

The City of London Electric Lighting Co., Ltd., reports a net revenue for 1937 of £151,725, as compared with £157,058 in the previous year, to which is added £72,109 brought in, making £223,834. The ordinary dividend for the year is maintained at 7½ per cent., less tax, £2,472 is placed to No. 2 reserve, and £95,362 is carried forward. On July 1st the whole of the 5 per cent. first debenture stock was redeemed at a premium of 25 per cent. The agreement between the company and the County of London Electric Supply Co., Ltd., has been put into operation, and an interconnection of mains was made towards the end of the year. The sales of electricity during the year amounted to 140,220,793 kWh, an increase of 6,133,705 kWh, and connections rose by 3,814 kW to 147,860 kW. Meeting: March 16th.

The British Power & Light Corporation, Ltd., reports a revenue for 1937 of £215,438, as compared with £201,540 in the preceding year, and a net profit of £156,489 (against £154,454). It is proposed to pay a final dividend of 5 per cent. (against 4 per cent.), making 7 per cent. for the year (6 per cent.), and to carry forward £66,742 (against £62,015 brought in). The report states that the number of consumers connected by Electricity Distribution of North Wales and District, Ltd., increased by 14.7 per cent. Sales of electricity increased by 16.7 per cent. The number of consumers connected by English distribution companies increased by 16.6 per cent. The sales to domestic consumers rose by 28.9 per cent., and for power by 47.5 per cent. Meeting: March 17th.

The North Wales Power Co., Ltd., reports a profit for 1937 of £121,940, as compared with £91,369 for 1936. The dividend for the year is 5½ per cent. (against 7 per cent.), but is payable on a doubled capital. The balance carried forward is £7,804 (against £4,691 brought in). The sales of electricity rose by 10.1 per cent. to 112,171,990 kWh.

Bruce Peebles & Co., Ltd., report a profit for the year ended December 31st of £39,412, as compared with £37,796 for the preceding year, which with £4,020 brought in makes £43,432. Depreciation account receives £8,000 and general reserve £17,321. The ordinary dividends are resumed with a payment of 5 per cent. for the year and £4,115 is carried forward. In July last the arrears of the cumulative 7½ per cent. dividend on the preference shares for the six years to December 31st, 1936, were cancelled, and in consideration thereof there were issued to the preference shareholders 15,321 fully paid ordinary shares of £1 each, being the equivalent in nominal value of 30 per cent. of the nominal amount of the preference shares held by each shareholder. To provide for this issue of ordinary shares £15,321 was transferred from general reserve to share capital account.

British Ropes, Ltd., is paying an ordinary dividend of 25 per cent., less tax, for 1937 (same). The dividend is payable on the ordinary capital as increased by the issue of 869,488 shares to holders in February of last year, bringing the total up to £438,119 in shares of 2s. 6d. each.

The Scottish Power Co., Ltd., reports a balance of revenue for 1937, including £10,468 brought in, of £390,340, as compared with £351,639 for 1936. Loan interest absorbs £11,570 and £28,500 is placed to general reserve. The final ordinary dividend is 5½ per cent., making 8 per cent. for the year (same), and £10,695 is carried forward.

The South Metropolitan Electric Light & Power Co., Ltd., is maintaining the dividend on the ordinary shares at 9 per cent. by the final payment of 6 per cent.

The Electrolux Corporation reports a consolidated net profit for 1937 of $2,775,498, as against $3,025,688 for 1936. The net profit for the fourth quarter of 1937 amounted to $621,604 as against $834,356 for the corresponding quarter of 1936. The figures have been arrived at after deducting all charges and Federal tax, and after making provision for surtax on undistributed profits.

The Telegraph Construction & Maintenance Co., Ltd., reports a trading profit for 1937 of £67,806, as against £57,338 in the previous year, plus investment income, &c., £11,119, and transfer registration fees, £102. Reserve for contingencies receives £25,000 and the net profit is £37,729 (against £29,115). The final dividend is 5 per cent., making 10 per cent. (against 7½ per cent.), and £31,867 is carried forward (against £31,488 brought in). Meeting: March 15th.

Veritys, Ltd., report a net profit for 1937 of £41,499, as against £10,463 for 1936, which with £10,463 brought in makes £51,962. A sum of £2,000 has been applied to writing down the investment in the subsidiary company, and £30,000 is placed to reserve. It is proposed to pay a dividend of 10 per cent. and to carry forward £9,095. Meeting March 31st.

Switchgear & Cowans, Ltd., is paying a dividend of 20 per cent. for 1937. A similar distribution was made for the previous year, but was paid on smaller capital.

The Lancashire Dynamo & Crypto, Ltd., has declared a final dividend of 17½ per cent., less tax, making 25 per cent. for the year (against 20 per cent.). The approximate net profit is £133,000, as compared with £82,000.

The Watford Electric and Manufacturing Co., Ltd., has declared a final dividend of 10 per cent., making 15 per cent. for 1937. A dividend of 7½ per cent. actual was paid for the first period June 24th to December 31st, 1936.

Brown Bros., Ltd., are paying a final dividend of 10 per cent., less tax, making 12½ per cent. for the year. A similar distribution was made for 1936 but was paid on smaller capital.

W. Canning & Co., Ltd., are paying a final dividend of 5 per cent., plus a bonus of 15 per cent., both less tax, making 25 per cent. for the year (same).

The Asea Co. (Stockholm) reports a net profit of Kr. 9,450,000 (against Kr. 8,200,000). The dividend for the year is 10 per cent. (against 9 per cent.), and Kr. 6,270,000 is carried forward.

The National Gas and Oil Engine Co., Ltd., is paying a dividend of 4 per cent. for the year (against 2 per cent.).

Stocks and Shares

TUESDAY EVENING.

THE Government announcement of an armament expenditure which seems likely to prove of staggering proportions, has brought about declines in the prices of most stocks and shares. It further emphasised the dullness which had previously overspread various sections of the industrial markets. On top of the armament programme, officially described as "terrifying" there has come a fresh blow at confidence in American securities. So obscure is the outlook, indeed, that no particular surprise is felt at the decision of investment to wait upon the course of events before absorbing stocks and shares that, at present prices, and on the basis of dividends now being distributed, look reasonably priced. The result of this hesitation is that quotations in most markets have gone back, while the volume of business has contracted to a point at which members of the House say it is more like that which obtains at the height of the Dog Days than that which brokers and jobbers expect to see when the Ides of March draw near. The suspension of a well-known firm of brokers in the New York Stock Exchange came as an unexpected development on this, Tuesday, afternoon.

Enfield Cable

Since publication of the annual report, the price of Enfield Cable shares has fallen from 5½ to 4 7/16 ex-dividend. Allowing for the dividend deduction, this means a drop of 19s. in the price. The latter still includes rights to the 60 per cent. scrip bonus, the announcement of which had previously caused a spurt of about 10s. in the quotation. The reason for the fall in price is the cold douche administered by disclosure of a decline in the year's profits on hopes which had been quite naturally engendered by the liberal scrip bonus. This year's distribution of shares is, however, a very different thing from the 1935 scrip bonus of 25 per cent., which, in 1936, had the agreeable sequel of a maintenance of the same rate of cash dividend on the increased capital. From the current profits statement, no less than from the official announcement, it is

now recognised that future dividends on the larger capital will start on a lower scale. This means, of course, that while the balance sheet will show a closer relationship between the capital and the value of the assets, the position of shareholders is altered not at all, from the point of view either of dividends or the value of their holdings. On the calculation that the 1937 earnings are equivalent to about 20 per cent. on the newly increased capital, it is estimated that the altered scale of dividends will start next year at about 15 per cent.

Electrical Equipment Prices and Dividends

Shares in cable manufacturing companies mostly followed the price of Enfield Cables in turning from strength to dullness. Callenders, which had previously risen from 4 3/16 to 4 3/8, are back to 4 1/16. British Insulated have lost 1/16 to 4 5/16, and Henleys 1/16 to 17s. 6d. Crompton Parkinsons have relapsed to 23s. 9d., and most of the other leaders in the electrical equipment market, including General Electrics at 71s., and Associated Electricals at 40s. 6d., are easier. Elsewhere, there are signs of sagging—in Crabtree Electricals at 26s. 3d., English Electric at 30s., and Westinghouse Brakes at 55s. Hall Telephones have eased, since the report, to 22s. 6d., ex-dividend. The Switchgear & Cowans dividend of 20 per cent., the same as for last year, was a disappointment to some expectations, and the price went back from 17s. to 14s., ex-dividend, at which the 5s. shares yield over 7 per cent. on the money. Watford Electric 2s. ordinary shares at 4s. pay 7½ per cent. on the 15 per cent. dividend just declared. This is at the same rate as its predecessor. Following the declaration of a dividend making 55 per cent. for the year, Walsall Conduits went ahead from 24s. 6d. to 25s. 6d., but fell away later to 24s., still cum-dividend. Lancashire Dynamos were lowered to 3¼ on the eve of the dividend announcement.

Electricity Supply Shares

Last week's fresh batch of dividends and reports in the market for electricity supply shares was notable for the appearance of the Metropolitan and North Metropolitan results. Both showed useful expansion. The raising of the dividend on the increased Metropolitan ordinary capital to 12 per cent. was recognised by a 2s. rise in the price of the shares. For last year the payment was 10 per cent., plus a jubilee cash bonus of 2½ per cent., on a smaller number of shares. The yield on Metropolitans, which are now quoted at 46s. 6d. ex dividend, is £5 3s. 3d. per cent. On North Metropolitans, which have risen 1s. to 48s. 9d., ex dividend, the return is £4 2s. per cent. Reports from Lancashire Electric, Midland Counties, Northampton Electric and other companies, as well as from the London and Home Counties Authority, all added to the impression of the industry's steady progress, which has been responsible for the firmness of electricity supply shares during the unsettlement of other markets. The market was prepared in advance for the Prime Minister's announcement that the Electricity Bill will not be introduced before next session. No disturbance, therefore, has ruffled the composure with which the market awaits the Government's scheme for reorganisation of the industry.

A. C. Cossor Issue

Last week's offer of ordinary and preference shares by A. C. Cossor, manufacturers of electrical and radio equipment, found the markets in their least enterprising mood, with the result that public subscriptions fell greatly short of the amount available. Dealing in the shares started this week. The 5s. ordinary, issued at 7s. 6d., are changing hands around 5s., and the 6 per cent. preference, issued at 20s. 6d., at 3s. discount. The yield on the preference shares, on which, the prospectus stated, the dividend is covered nearly seven times by the average profits for the last five years, works out at nearly 7 per cent. at 17s. 6d. Ismay Industries fell at one time from 5s. 3d. to 4s. 3d., but recovered to 4s. 9d. This company holds a million Cossor ordinary shares, and has agreed not to market them for three years. Underwriters of Cossor shares are understood to have been left with about 80 per cent. of their obligations. This implies a poor market in the shares until the underwriters have disposed of whatever they wish to sell.

Miscellaneous Matters

Pending some news of negotiations between the combine and the Empire Governments, the price of Cable and Wireless ordinary stock has gone back to 65; the funding stock has also lost a point to 101½. Among traction stocks, Tillings have fallen to 55s. 6d. ex dividend. At the end of the Home Railway "season" of dividends, reports and meetings, the market appears dull and listless. Brazilian Tractions have fallen away to 10¼, and Argentine traction stocks have fallen into neglect since publication of the Buenos Ayres transport co-ordination plan. Of the Anglo-Argentine Tramway debenture stocks, the five per cents, at 15½, are 3 points down, and the "fours," at 30, have fallen a further 2 points. Prices in the gilt-edged market recoiled to some extent in face of the rearmament expenditure figure, but became steadier under the persistent pressure of unemployed money. The newly placed Electric Construction 7½ per cent. preference shares are now in the market. Shares are changing hands at around 28s. Vickers disappointed the market by not writing up further the value of the 10s. ordinary units: the dividend of 10 per cent. was as expected. At 20s. 9d. the price of the shares is about 2s. down.

Share List of Electrical Companies

	Dividend. Nom. Previous.	Dividend. Nom. Last.	Price Mar. 8.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.					
Bournemouth and Poole	1	15	15	66/3xd.	—	4 10 8
City of London	1	7½	7½	34/–	—	4 8 3
Clyde Valley	1	7	8	39/6xd.	—	4 1 0
County of London	1	10½	10½	49/–xd.	—	4 5 9
Edmundson's 7% Pref.	1	7	7	32/6	—	4 6 2
Do. Ord.	1	8	9	38/–	—	4 14 9
Elec. Dis. Yorkshire	1	9	9	42/–	—	4 5 10
Elec. Fin. and Securities	1	12½	12½	51/3	—	4 17 6
Elec. Supply Corporation	1	11	12	52/6	—	4 11 5
Lancs Light and Power	1	7½	7½	33/6xd.	—	4 9 7
Lond. Assoc. Electric	1	—	7	31/3xd.	—	4 9 8
London Electric	1	8	7	35/6	—	3 19 9
London Power Deb. Red.	Stock	5	5	106	—	4 14 4
Metropolitan	1	10	12	46/6xd.	+2/–	5 3 3
Midland Counties	1	7½	8	37/–xd.	—	4 6 6
Mid. Elec. Power	1	8	9	2 1/16	—	4 7 4
North Eastern Electric Ordinary	1	6	7	31/–xd.	—	4 10 6
Do. 7% Pref.	1	7	7	32/6xd.	—	4 6 2
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	48/9xd.	+1/–	4 2 9
Do. do. 6% Pref.	1	6	6	30/–	—	4 0 0
Scottish Power	1	8	8	37/–xd.	—	4 6 6
South London	1	7	7	32/–xd.	—	4 7 5
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/6xd.	–1/–	7 14 9
Yorkshire Elec.	1	8	8	40/–	—	4 0 0
PUBLIC BOARDS						
Central Electricity, 1950–70	Stock	5	5	113	—	4 8 6
Do. 1955–75	„	5	5	116xd.	—	4 6 2
Do. 1951–73	„	4½	4½	111	—	4 1 1
Do. 1963–93	„	—	3½	100	—	3 10 0
London Elec. Trans. Gtd.	„	—	2½	92½	+½	2 14 2
London & Home Counties, 1955–75	„	4½	4½	112	—	4 0 4
London Passenger Transport, A	„	—	4½	118½	—	3 16 3
Do. do. B	„	—	5	121½	—	4 2 4
Do. do. C	„	4	4½	83½	—	5 1 10
West Midlands Joint Elec. 1948–68	„	—	5	113xd.	—	4 8 6
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	135½	–2	6 12 10
Anglo-Am. Tel. Pref.	Stock	6	6	111½	—	5 7 7
Do. Def.	„	1½	1½	27	—	5 11 3
Cable & Wireless 5½% Pref.	„	4½	5½	101xd.	—	5 9 0
Do. Ord.	„	—	—	65	–1	—
Do. Income	„	—	—	101½	–1	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	14 1/16xd.	—	3 15 3
Do. do. Pref.	10	6	6	13⅜	—	4 8 1
Great Northern Tel.	10	20	20	39½	—	5 1 3
Marconi-Marine	1	10	7½	28/9	—	5 4 4
Oriental Telephone Ord.	1	12*	12*	2 1/16	—	4 9 3
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	6/–	–1/–	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	15½	–3	—
British Electric Traction Def. Ord.	„	5	5	962	—	—
Do. do. Pref. Ord.	„	8	8	160	—	4 17 0
Brazil Traction	$100	70 cts.	$1	10½	–⅛	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	102½	—	4 17 9
Mexican Light Common	$100	Nil	Nil	1½	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	12	3	—	4 0 0
West Riding	1	6½	10	38/9xd.	–1/16	5 3 3
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	15	15	1¾	—	8 0 0
Assoc. Elec. Ord.	1	8	10	40/6	–6d.	4 18 9
Do. Pref.	1	8	8	38/–	—	4 4 6
Babcock & Wilcox	1	8	10	42/–	–9d.	5 0 0
British Aluminium Ord.	1	7½	10	44/6	–1/16	4 9 10
British Insulated Ord.	Stock	20	20	4 1/16	–1/16	4 12 10
Brush Ord.	Stock	Nil	Nil	19½	–2	—
Callender's	1	15	15	4 1/16	+1/16	3 9 9
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/–	12½	12½	23/9	–⅛	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	36/3	—	5 10 6
Enfield Cable Ord.	1	25	25	4 1/16xd.	–⅛	5 12 7
English Electric	1	Nil	10	30/–	–1/–	6 13 4
Do. do. Pref.	1	6½	6½	25/–xd.	—	5 4 0
Ericsson Tel.	5/–	20	25*	1¾	—	3 6 7
Ever Ready	5/–	35	45	25/6	–6d.	8 16 6
Ferranti Pref.	1	7	7	27/6	—	5 1 10
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	71/–	–1/–	4 18 7
Henley's	5/–	30	15	17/6	–1/16	4 5 9
Do. 4½% Pref.	1	4½	4½	1 1/16	–1/16	4 4 8
India-Rubber Pref.	1	5½	5½	22/–	—	5 0 0
Johnson & Phillips	1	½	10	38/9	—	5 3 1
Lancashire Dynamo	1	10	20	3½	–1/16	6 3 0
Siemens Ord.	1	6	7½	28/9	—	5 4 4
Telegraph Construction	£1	7½	10	2	+1/16	5 0 0

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1936

13019. "Radio direction-finder or course-indicator for aircraft, ships and the like." J. R. Steinhoff. May 14th, 1935. (479747.)

13049. "Means for producing a constant electric current capable of adjustment." Almanna Svenska Elektriska Aktiebolaget. May 17th, 1935. (479596.)

15455. "Apparatus for the production of accumulator plates." L. N. Ascari. June 2nd, 1936. (Convention date not granted.) (479517.)

16155. "Arc convertors." Siemens-Schuckertwerke Akt.-Ges. July 18th, 1935. (479863.)

18138. "Electro-mechanical display apparatus." Scholl Manufacturing Co., Ltd., and G. Thornton-Norris. June 30th, 1936. (479520.)

18708. "Electric micrometers." General Electric Co., Ltd., H. C. Turner and T. C. Nuttall. July 6th, 1936. (479523.)

18830. "Insulation testing and measuring apparatus." Claude General Neon Lights, Ltd., G. M. T. Lambrick and S. G. Rison. July 7th, 1936. (479684.)

18892. "Modulated carrier-wave receivers." A. D. Blumein and W. H. Connell. July 8th, 1936. (479599.)

19148. "Electron-discharge devices for use in television and like systems." Baird Television, Ltd., and P. W. Willans. July 10th, 1936. (479750.)

21514. "Television receiving apparatus." J. E. Mead and H. G. M. Spratt. August 5th, 1936. (479751.)

21725. "Air-space - insulated high - frequency electric cables." Siemens & Halske Akt. Ges. August 12th, 1935. (479841.)

21820. "Thermal switches." General Electric Co., Ltd., S. J. Hewlett and C. W. Stopford. August 7th, 1936. (479756.)

21893. "Radio direction-finding systems." Plessey Co., Ltd., and C. E. G. Bailey. August 8th, 1936. (479689.)

21927. "Enclosed electric plug contacts." Siemens-Schuckertwerke Akt. Ges. August 16th, 1935. (479844.)

21945. "Electrical measuring apparatus." A. Nemet. August 26th, 1935. (479527.)

21970. "Television and like systems." Baird Television, Ltd., and D. M. Johnstone. August 10th, 1936. (479760.)

21972. "Electron-discharge devices." Baird Television, Ltd., and C. Szegho. August 10th, 1936. (479761.)

21975. "Electric signalling systems, more particularly fire-alarm and like systems." N. E. Brookes (Gamewell Co.). August 10th, 1936. (479762.)

21978. "Alternating-current electric switches." General Electric Co., Ltd., and C. J. O. Garrard. August 10th, 1936. (479603.)

22034. "Frequency-changer networks for use in superheterodyne radio-receivers and the like." Marconi's Wireless Telegraph Co., Ltd. August 10th, 1935. (479768.)

22037. "Electro-magnetic relays." Automatic Electric Co., Ltd. (in liquidation), and C. R. Woodland. August 10th, 1936. (479769.)

22047. "Alternating-current measuring-arrangements." Siemens & Halske Akt. Ges. October 3rd, 1935. (479771.)

22073. "Electric-lighting fittings." Wardle Engineering Co., Ltd., and D. H. Ogley. August 11th, 1936. (479906.)

22075. "Electric heater particularly for kettles and like domestic vessels and utensils." London Aluminium Co., Ltd., and A. E. Heeley. August 11th, 1936. (479907.)

22091. "Liquid-insulated electric circuit-breakers." A. Reyrolle & Co., Ltd., and A. Allan. August 11th, 1936. (479850.)

22120. "Automatic or semi-automatic telephone systems." Automatic Electric Co., Ltd. (in liquidation), C. Gillings, R. Taylor and G. T. Baker. August 11th, 1936. (479852.)

22182. "Means of and apparatus for transmitting and receiving messages through long cables." W. Estaugh. August 12th, 1936. (479911.)

22193. "Electrical immersion heaters." T. H. Stiebel. August 12th, 1936. (479859.)

22395. "Electric alarm system." W. L. Harris and A. B. Seith. August 14th, 1936. (479873.)

22400. "Apparatus for regulating the frequency of an oscillatory system." G. Schotel. August 14th, 1936. (479874.)

22448. "Electric rectifiers." British Thomson-Houston Co., Ltd., and G. A. Carrick. August 14th, 1936. (479879.)

22458. "High-frequency induction coil with adjustable inductance value." Standard Telephones & Cables, Ltd., T. Johnston and L. W. Hallett. August 14th, 1936. (479880.)

22461. "Electrical communication systems." Standard Telephones & Cables, Ltd., and C. B. V. Neilson. August 14th, 1936. (479881.)

22462. "Thermionic amplifying systems." Standard Telephones & Cables, Ltd., and C. E. Strong. August 14th, 1936. (479882.)

22464. "Heavy-current high-tension cable." Standard Telephones & Cables, Ltd. August 17th, 1935. (479883.)

22467. "Electrical signalling systems." Automatic Electric Co., Ltd. (in liquidation), F. McCabe and W. Saville. August 14th, 1936. (479884.)

22471. "Jewel bearings for electric meters and the like." Sangamo Electric Co. May 8th, 1936. (479885.)

22478. "Electrical conductors." Soc. d'Etudes et d'Applications Industrielles Soc. Anon. April 30th, 1936. (Cognate application 22479/36.) (479915.)

23590. "Generating heat electrically." T. Hamilton-Adams. August 28th, 1936. (479535.)

23671. "Automatic temperature-control systems." H. Smethurst, W. L. Lothian, and Metropolitan-Vickers Electrical Co., Ltd. August 28th, 1936. (479611.)

24138. "Electric switch-operating gear." General Electric Co., Ltd., and F. J. Keeley. September 3rd, 1936. (479537.)

25953. "Apparatus for increasing the size and/or brightness of pictures produced by picture-projection apparatus, for television and other purposes." F. Skaupy. September 24th, 1935. (479617.)

27873. "Electric tail-lamp for automobiles and railway trains." C. F. Smith. October 14th, 1936. (479620.)

28276. "Electro-magnetic control devices for circuit-interrupters and switches." British Thomson-Houston Co., Ltd. October 17th, 1935. (479621.)

29997. "Adjustable mounting for electric lamps." Chance Bros. & Co., and V. A. W. Stacey. November 4th, 1936. (479697.)

31058. "Electric-discharge devices." British Thomson-Houston Co., Ltd. November 20th, 1935. (479699.)

31870. "Loudspeaker arrangements for public address systems." Telefunken Ges für Drahtlose Telegraphie. December 16th, 1935. (479549.)

33926. "Television transmission." Radioakt.-Ges. D. S. Loewe. December 10th, 1935. (479551.)

33989. "Current-collectors for transformers and like apparatus." A. De Backer. January 20th, 1936. (479552.)

34402. "Image-suppression circuits for superheterodyne radio receivers." Philco Radio and Television Corporation. April 27th, 1936. (479788.)

35007. "Telephone systems." W. K. Brasher. December 21st, 1936. (479554.)

1937

2471. "Prevention of interference in radio apparatus in motor vehicles." J. J. V. Armstrong (R. Bosch Akt.-Ges.). February 12th, 1937. (479794.)

4298. "Piezo-electric crystals." Standard Telephones and Cables, Ltd. May 1st, 1936. (479637.)

4517. "Mercury-cathode discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 17th, 1936. (479564.)

6581. "Electro-magnetic phonographic reproducers." Dictaphone Corporation. October 4th, 1935. (Divided out of 464739.) (479566.)

7103. "Protective arrangements for electrical apparatus having cooling means." British Thomson-Houston Co., Ltd. March 10th, 1936. (479568.)

9300. "Thermionic amplifiers." Standard Telephones and Cables, Ltd. April 1st, 1936. (479808.)

13692. "Piezo-electric crystal arrangements." Telefunken Ges für drahtlose Telegraphie. May 14th, 1936. (479575.)

13802. "Filling and venting devices for electric accumulators." Chloride Electrical Storage Co., Ltd. (L. E. Lighton). May 18th, 1937. (479724.)

14105. "Devices for the resistance compensation of metallic conductors in response to temperature variations." Siemens and Halske Akt.-Ges. May 20th, 1936. (479577.)

14481. "Electrically operated resonance device for the control of definite operations." Landis and Gyr Akt.-Ges. June 18th, 1936. (479725.)

14915. "Electric water-heaters." W. F. Tipping. May 28th, 1937. (479582.)

15582. "Electric circuit-breakers having arc-extinguishing devices." Westinghouse Electric and Manufacturing Co. June 5th, 1936. (479728.)

15766. "Signal transmission systems." Marconi's Wireless Telegraph Co., Ltd. June 5th, 1936. (479731.)

16150. "Electric discharge devices." British Thomson-Houston Co., Ltd. June 11th, 1936. (479824.)

16244. "Electric relaxation oscillators." Radioakt.-Ges. D. S. Loewe. June 20th, 1936. (479732.)

17368. "Manufacture of activated electrodes for photo-electric cells or secondary electron multipliers." Zeiss Ikon Akt.-Ges. July 4th, 1936. (479733.)

17706. "Photo-voltaic cells." Electrical Research Products, Inc. June 25th, 1936. (479825.)

17723. "High-frequency electric wave signalling systems." Standard Telephones and Cables, Ltd. July 18th, 1936. (479658.)

18611. "Electrodes for short wave medical treatment." S. Siebs. July 8th, 1936. (479735.)

18895. "Cathode ray tube apparatus." C. Lorenz Akt.-Ges. July 7th, 1936. (479737.)

20151. "Dry contact rectifiers." Suddeutsche Apparate Fabrik Ges. August 3rd, 1936. (479666.)

21189. "Telephone or like transmission systems." Standard Telephones and Cables, Ltd. September 16th, 1936. (479668.)

21234. "Electric lampholders." Revo Electric Co., Ltd., and F. H. Reeves. August 3rd, 1937. (479669.)

22851. "Electric synchronous motors." Junghans Akt.-Ges. Geb. August 22nd, 1936. (Addition to 449299.) (470673.)

30616. "Automatic or semi-automatic telephone systems." Automatic Electric Co., Ltd. (in liquidation), C. Gillings, R. Taylor and G. T. Baker. August 11th, 1936. (Divided out of 479652.) (479895.)

32235. "Resistance controllers for electric motors." British Thomson-Houston Co., Ltd. November 18th, 1935. (Divided out of 479384.) (479745.)

32956. "Means for producing a constant electric current capable of adjustment." Allmanna Svenska Elektriska Aktiebolaget, and U. Lamm. May 8th, 1936. (Divided out of 479596.) (479834.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 2nd.

Nivoc. No. 581131. Class 13. Metal reflectors. No. 581134. Class 50. Synthetic resin and compressed fibre, &c.—W. & J. George, Ltd., 157, Great Charles Street, Birmingham.

Spinney (lettering and design). No. 579318. Class 50. Electric insulating materials, lamp shades (celluloid), &c.—Littlewood's Mail Order Stores, Ltd., Littlewood Buildings, 100-110, Oldhall Street, Liverpool.

Catalin. Nos. 580295, 580333 and 580334. Class 50 (lettering only in one case and two with lettering and different design). Synthetic resin sold in solid or plastic form for industrial purposes and articles made therefrom, &c.—Catalin, Ltd., 3, Vere Street, London, W.1.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aireborough.—Houses (156), High Henshaw, Yeadon; U.D.C. surveyor, Micklefield House, Rawdon.

Barking.—Cinema, London Road; Odeon (Barking), Ltd. Seven shops and flats, East Street; Rego (Clothiers), Ltd.

Basingstoke.—Houses (28), Highfield estate, Deep Lane; H. G. Winterage.

Berkshire.—Enlargement of Institution, Easthampstead; county architect.

Birmingham.—Houses (48), Lea Hall estate (£16,002); Morris, Jacombs & Sons, Ltd. School, Sheldon (£41,200), for the E.C.

Blackpool.—Houses, Bispham estate; W. Schofield, contractor, Blackpool.

Blairgowrie.—Cinema, for J. B. Milne, Victoria Cinema, Victoria Road, Dundee.

Bolton.—Houses (20), Blackburn Road; F. & H. Douglas. Houses (18), Sunnyside Avenue; W. E. Yates.

Bootle.—Police courts, Pembroke Road (£5,178); borough engineer.

Bradford.—Houses, Broomfield area and Clayton estate; city architect.

Brierley Hill.—Houses (148), Brockmoor, Pensnett and Wordsley; R. H. J. Comber, U.D.C. surveyor, Albion Street.

Bristol.—Central garage, Albert Road (£51,000); city engineer. Flats (28), Great Ann Street (£17,000); South Eastern Contractors, Ltd. School, Bishopsworth Lane, for the E.C. Improvement of R.C. schools (£40,000); R.C. trustees.

Cardiff.—Block of offices (£60,000), near Law Courts; city engineer.

Cheltenham.—Houses (52), Brooklyn Road; Western Estates, Ltd.

Chesterton.—Houses (24), seven parishes; J. R. Oxenham, architect, County Hall, Hobson Street, Cambridge.

Colchester.—Additions and alterations to Wilson Marriage Council school (£15,345), for the E.C.; F. Hutton & Son, builders, Birch.

Conisborough.—Extensions to Isolation Hospital, Crookhill Road, for Doncaster and Mexborough Joint Hospital Board; Walker & Thompson, architects, 7b, Hall Gate, Doncaster.

Cramlington (NORTHUMBERLAND).—Houses (180); J. E. Gardner, builder, St. Cuthbert's Road, Gateshead-on-Tyne.

Crook.—Factory for the Hampton Timber Co., Hampton, Middlesex.

Denbighshire.—Enlargement of girls' school, Wrexham (£33,294), for the County E.C.

Depwade.—Houses (67), various parishes; F. H. Bowden, Long Stratton.

Dudley.—Houses (144), Cole Street (£46,659); Eadie & Co., Wolverhampton. Houses (19), Halesowen Road; B. Jones.

Eastbourne.—Council offices, Saffrons site; borough engineer.

Eccles.—Houses (72), Bray Avenue, Winton; J. Valentine. School, Swinton, for the E.C.

Edinburgh.—Houses (143), Crewe Road North, for Corporation; E. J. MacRae, city architect.

Enfield.—Houses (87), Great Cambridge Road; D. Thomson. Houses (61), Oatlands Road, W. Goodchild & Co. Factory, Hertford Road; G. P. Walker & Sons.

Eston.—Cinema, Bolckow Road; P. Lanny.

Falkirk.—Ice rink (£40,000); Wilson and Wilson, architects, Falkirk and Grangemouth.

Gateshead-on-Tyne.—Hospital (£236,000); F. R. Patterson, borough engineer, Town Hall.

Glasgow.—Houses (182), Parliamentary Road; housing director. Cinema, Govan Road, for Caledon Pictures, Ltd., 21, Blythswood Square; C. J. McNair, architect, 272, St. Vincent Street. Gymnasium, &c., Bellahouston school (£20,000), for the E.C. Showroom, offices, &c., 19 to 27, West Campbell Street and 150 to 156, Holm Street, for Siemens Electric Lamps and Supplies, Ltd., 25 to 27, Cadogan Street; R. B. Burden, architect, 100, Victoria Street, Westminster, London, S.W.1.

Halesowen.—Houses (162), Hasbury Farm estate (£55,120); borough engineer.

Ilkeston.—School, Field House estate, for the E.C.

Ireland. — (ENNISCORTHY, Co. WEXFORD). — Houses (14), Milehouse, Enniscorthy, for the Wexford Board of Health, Wexford; O. Sullivan and Jordan, architects and engineers, 104, Grafton Street, Dublin. (SCHULL, Co. CORK).—Cottage hospital, for the West Cork Board of Health, County Home, Clonakilty; J. J. O'Crowley, architect, Clonakilty, Co. Cork.

Isle of Wight.—School, Sandown (£48,338), for the County E.C. Extensions to Parkhurst Institution, Parkhurst (£4,000), for the County Council.

Kettering.—Extensions to factory, for T. G. Wright (Kettering), Ltd., Cross Street.

Kidderminster.—Houses (119), Foley Park estate, borough engineer.

Leeds.—News cinema, Corner House, Moortown; W. Hobson.

Leyton.—Enlargement of Rinkholt school (£30,929), for the E.C.

Liverpool.—Houses (186), Ivy Farm estate, Longton Lane, Holt Lane and Sandhurst Road, Rainhill; C. Oldham, builder, Royal Green Road, Northenden, Manchester. Stores for Phillips Furnishing Stores, Ltd., Sheffield.

London.—(DEPTFORD).—Extensions to factory, for J. Stone & Co., Ltd., Arklow Road. (FINCHLEY).—Houses (23), Parklands Drive; Golders, Ltd., 57, Boyne Avenue, London, N.W.5. Houses, Red Lion estate (£23,289); Kent & Sussex Building Co., Ltd. (LAMBETH).—Cider factory, Glasshouse Walk, for Whiteways Cider Co., Ltd. (SOUTHWARK).—Factory, Norfolk Street; Stock & Page, 18, St. Thomas Street, S.E.1.

Lutterworth.—Houses (48), Leicester Road; R.D.C. surveyor.

Maltby.—Cinema (1,016 seats), corner site opposite Queen's Hotel, for the Ritz Cinema Co., Sheffield.

Merthyr Tydfil.—Houses (216), Galon Uchaf site (£110,000); borough surveyor.

Murton (Co. DURHAM).—Houses (224), for the North-Eastern Housing Association; J. Clark & Son, builders, Seaham Harbour.

Newcastle-on-Tyne.—Branch library, Brinkburn Street, for the City Council; city architect.

Northampton.—Houses (45), Norton Road; Chowns, Ltd.

Northamptonshire.—Additions to County Buildings, Northampton (£32,400), for County Council; William Moss & Sons, Ltd., Loughborough. Extensions to Institution, Daventry (£8,000), for County Council.

Oldbury.—Houses (14), Hill Top Road; S. Spollen.

Oxford.—Casual wards, Langford Lane (£29,000); Berkshire, Buckinghamshire and Oxfordshire Joint Vagrancy Committee.

Plymouth.—Houses, St. Peter's Park and Stonehouse estates (£76,000); borough engineer.

Pontefract.—Bus station, Horsefair; borough engineer.

Portsmouth.—Houses (148), Wymering estate (£66,066); city engineer.

Rochester (KENT).—School, Cliffe Road, Frindsbury, for the E.C.; E. H. Webb, secretary, Education Offices, Strood House, Corporation Street.

Rotherham.—Houses (38), Droppingwell Road; A. Watson. Houses (30), Moorgate Road; M. F. Moncaster. Six shops and houses, near Wellgate; D. Dunk.

Seaton Valley (NORTHUMBERLAND).—Houses (175); Gibson Bros., builders, Hill Heads, Whitley Bay.

Shildon (Co. DURHAM).—Houses (20), for North-Eastern Housing Association, Newcastle-on-Tyne.

Shropshire.—Schools, Crudgington, Ellesmere and Newport, for the County E.C.

Slough.—Factories, Berkshire Avenue and Buckingham Avenue; Slough Estates, Ltd. Houses (38), near Bath Road, Salt Hill; P. A. Smith. Houses (222), near Shaggy Calf Lane and Wexham Road; G. Wimpey & Co., Ltd. Extensions to works, for A. M. Archer & Co., Ltd., Wellington Street.

Smethwick.—Flats (64), Thimble Mill Road (£31,491), with electrical work; Housing, Ltd., builders, Station Road, Blackheath, Birmingham.

South Shields.—Block of offices, Rutland Street, for Wright & Son (1933), Ltd.; Bewley & Scott, builders, Dunston-on-Tyne. Offices for Vasey and Reed; Page, Son & Bradbury, architects, 75, King Street. School, Wenlock Road; borough engineer. Extensions to hospital (£23,000); J. Reid, borough surveyor, Town Hall.

Staffordshire.—School, Kingswinford (£32,550), for the C.C.; county architect.

Stalybridge.—Bus station, Angel Inn site; borough engineer.

Stockport.—Reconstruction of "Alexandra" Cinema, Castle Street, Edgeley, for Jefton Entertainments, Ltd., Midland Bank Chambers, Cross Street, Manchester; J. H. Cassel & Co., contractors, 297, Bury New Road, Broughton, Manchester, 7.

Stourport.—Offices and extensions to factory, Worcester Road, for Parson Chain Co., Ltd., 11, Victoria Street, London, S.W.1; Thomas Vale & Sons, Ltd., contractors, Lombard Street, Stourport.

Stretford.—Offices, &c., Trafford Park Road; Stretford & District Electricity Board.

Suffolk.—School, Mildenhall, alterations and additions to Mildenhall West Row Council school, and alterations, St. Mary Boys' school, Newmarket, for the West Suffolk E.C.; county architect, 13, Westgate Street, Bury St. Edmund's.

Sunderland.—Extensions to Town Hall (£60,000); borough engineer.

Sussex.—School, North Lancing (£15,380), for the West Sussex County Council, Chichester.

Sutton Coldfield.—Houses (14), Slade Road; R. T. Rix. Houses (28), Willmott Road; A. Walker. School, Holland Road (£50,020), for the E.C.

Swindon.—Houses (36), Devon Road; E. H. Bradley & Sons.

Torquay.—Concert hall, Babbacombe (£8,164); J. T. Sture.

Wakefield.—Houses (48), Middlestown, Netherton, Walton and Warmfield; W. E. Massie, R.D.C. surveyor, Council Offices, 18, St. John's North. Houses (230), Flanshaw estate (£86,400), and enlargement of Snapethorpe school (£17,218); G. Crook & Sons, Ltd. Houses (67), Haddingley Hall; D. F. Mann & Sons, builders, Thorpe.

Wallsend-on-Tyne.—Houses (142), Archer Street; North-Eastern Housing Association, Ltd. Houses (48), Low Willington Farm estate; Marshall & Tweedy, architects. School, High Farm estate (£150,000); J. A. Blench, borough surveyor, Town Hall. Extensions to works, North Terrace; Chas. Crofton & Co.

Walsall.—Shops, Stafford Street; Brockhurst & Wood, builders.

Wellingborough.—Extensions to Cottage Hospital (£4,000), for Management Committee; Moore & Son, architects, Sheep Street.

Whickham-on-Tyne.—Houses (37), Sunniside; E. Jeffcock, builder, Lemington-on-Tyne.

Workington.—Houses (28), Great Clifton, for the North-Eastern Housing Association, Ltd. (J. W. Tibbs, secretary). J. Twiname, Brigham, contractor, Cockermouth. Houses (44), Shore Road, Salterbeck; T. Armstrong, contractors, Lower Church Street, Workington.

Worsborough.—Municipal offices (£10,500); U.D.C. surveyor.

York.—Houses (13), Park Street; Sorrell & Scaife, Ltd. Houses (10), Water Lane estate (£3,650); Sherriff & Co., Ltd. Ballroom, Rialto, Fishergate; J. Prendergast.